PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

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Non-destructive testing
Industrial radiography
Corrosion
Electrical and magnetic measurements and instruments
Electronic relays and counters
Automatic control mechanisms
Applied electrochemistry
Photocells
Thermionic tubes
Cathode-ray tubes
X-ray tubes
Induction accelerators
Cyclotrons
Amplifiers
Radio-wave propagation
Mechanical engineering
Heat engines
Illumination
Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the right. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

[*Continued on page* 3 *of cover*]

MATHEMATICS 51

512.942

394. Effect of lines of force on *div* and *curl*. EMDE, F. *Arch. Elektrotech.*, **39**, 2–8 (*June*, 1948) *In German.*—The vector products, the affinor, turbor and deviator are defined and their interrelations given. The tangent vector and its *div* and *curl* are defined and their properties in a field whose lines of force are not parallel straight lines are considered. Conditions for the existence of orthogonal surfaces are discussed. J. A. W.

517.53/949

395. Mathematical analysis in the complex field in Italy (from 1939 to 1945). GHIZZETTI, A. *Rel. Pont. Acad. Sci.* (*Auct. Sci. Temp. Belli*) (*No.* 5) 3–35 (1939–45) *In Italian.*—Review, including a bibliography of 7 pages.

517.6 : 523.877

396. On the transforms of the integro-exponential functions K_n by the operators Λ and Φ. KOURGANOFF, V. *C.R. Acad. Sci., Paris*, **227**, 958–60 (*Nov.* 8, 1948) *In French.*—The paper is concerned with transformations arising from Milne's integral equations. R. A. N.

517.6 : 539.132

397. On certain integrals useful in molecular orbital calculations. PARR, R. G. AND CRAWFORD, B. L., JR. *J. Chem. Phys.*, **16**, 1049–56 (*Nov.*, 1948).—Previous calculations of integrals which enter computations by the method of antisymmetric molecular orbitals are reviewed, several new integrals are evaluated, and a master table of integrals is given. A.

517.63

398. Modern operational calculus based on the two-sided Laplace integral. I. VAN DER POL, B. AND BREMMER, H. *Proc. K. Ned. Akad. Wet.*, **51** (*No.* 8) 1005–12 (1948) *In English.*—The advantages claimed for an operational calculus based on

$$f(p) = p\int_{-\infty}^{\infty} \varepsilon^{-pt}h(t)dt$$

over that based on the Laplace transform having 0 as the lower limit of integration, are that the rules are capable of simpler formulation, and that the "two-sided" image function $f(p)$ is often simpler than the "one-sided" image $p\int_0^{\infty} \varepsilon^{-pt}h(t)dt$. Also, images having no original function $h(t)$ in the usual calculus can be considered. Examples are given. M. R. H.

518.4 : 534.44

399. A new method for the analysis of the graphs resulting from decaying sinusoidals. TOMEY, A. H. J. M. *Comment. Pont. Acad. Sci.*, **11** (*No.* 8) 273–328 (1947) *In French.*—The additive and subtractive combinations of Labrouste enable the transformation of one curve into others possessing useful properties. By the use of certain combinations, applied successively, selected sinusoids may be amplified and others diminished. Complete schemes are outlined for the analysis of the first 20 or first 40 harmonics of a given curve. Tables and "keys" are employed by which processes are simple arithmetical, the extraction of each harmonic being separately detailed. Twelve oscillograms covering phonetic and physiological phenomena are analysed as examples. A. J. K.

518.5 : 621.385.832 : 621.318.572

400. A storage system for use with binary-digital computing machines. WILLIAMS, F. C. AND KILBURN, T. *Instn Elect. Engrs, Advance Paper* 763, 18 *pp.* (*Nov.*, 1948).—Abstr. 472 B (1949).

519.251 : 519.271

401. Discrete means of experimental ordinates, or integrals? The rule of the identification of mean values, and the rule of least error. VERNOTTE, P. *C.R. Acad. Sci., Paris*, **227**, 897–8 (*Nov.* 3, 1948) *In French.*—The method developed by the author [see Abstr. 2016 (1940); *C.R. Acad. Sci., Paris*, **215**, 586 (1942); Abstr. 1772 (1946)] is discussed, and it is shown that, however attractive, the procedure is wrong, in that it supplies, by an artifice, values not determined by experiment. The rule of least error is shown to imply the identification of the mean values of the theoretical and experimental functions, a result which can only be obtained by the method if sums of the isolated ordinates, and not integrals, are used. S. W.

ASTRONOMY . ASTROPHYSICS . GEODESY 52

521.042

402. On the abundance of nuclei in the universe. II. Details of the abundances of medium-heavy and heavy nuclei. SUESS, H. E. *Z. Naturforsch.*, **2a**, 604–8 (*Nov.–Dec.*, 1947) *In German.*—Further details are discussed [see Abstr. 703 (1948)] especially of those elements found less in meteorites than elsewhere. G. J. K.

521.312

403. On the approximate integration of the equations for the problem of two bodies of variable mass. MICHELACCI, L. *Comment. Pont. Acad. Sci.*, **8** (*No.* 1) 1–12 (1944) *In Italian.*—Graffi's method [see Abstr. 3402 (1933)] is used to obtain an upper limit for the error involved in an approximate calculation of the mean anomaly in the osculating relative orbit. R. A. N.

522.6 : 621.38

404. Electronics in astronomy. KRON, G. E. *Electronics*, **21**, 98–103 (*Aug.*, 1948).—Abstr. 494 B (1949).

522.615 : 535.247.4

405. A method of reducing the effective time-constant of astronomical photoelectric photometers. JOHNSON, H. L. *Publ. Astr. Soc. Pacif.*, **60**, 303–6 (*Oct.*, 1948).—Explains the theory of the circuits used in photoelectric photometers with a suggestion to use a

negative feedback so as to improve the time constant. Experimental results are promised shortly. E. G. M.

522.982 : 535.246

406. Effects of image imperfections in physical photometry of in-focus stellar photographs. RIGGS, P. S. *Publ. Astr. Soc. Pacif.*, **60**, 307–16 (*Oct.*, 1948).—Errors in photometrically measured stellar magnitudes due to image distortions may be important, and also vary with image strength in an uncertain manner, though the effect vanishes for one particular weak image strength. The use of objective grating calibration, with the slight elongation of images due to the dispersion, is thus unreliable without special precautions. The results only apply to long-focus instruments and may be negligible for those of short focus. D. L. E.

523.12 : 521.042 : 539.17

407. The origin of elements and the separation of galaxies. GAMOW, G. Letter in *Phys. Rev.*, **74**, 505–6 (*Aug.* 15, 1948).—Earlier results [Abstr. 2933 (1948)] are used to estimate the densities and temperatures in the universe at early stages in its expansion. It is found that $\rho_{rad} \propto \sim t^{-2}$ and $\rho_{mat} \propto \sim t^{-3/2}$, and it is suggested that the process of galactic formation set in when $\rho_{rad} = \rho_{mat}$, i.e. $t \simeq 10^7$ years, the galaxies being originally entirely gaseous. R. A. N.

523.12 : 521.042 : 539.17

408. The evolution of the universe. GAMOW, G. *Nature, Lond.*, **162**, 680–2 (*Oct.* 30, 1948).—See Abstr. 407 (1949). The theory that the observed relative abundances of elements resulted from the rapid expansion of a dense over-heated neutron gas is further discussed. An estimate is made of the masses and diameters of galaxies assuming them to be formed by condensation in accordance with the principle of gravitational instability. R. A. N.

523.12 : 521.042 : 539.17

409. Evolution of the universe. ALPHER, R. A. AND HERMAN, R. Letter in *Nature, Lond.*, **162**, 774–5 (*Nov.* 13, 1948).—Various corrections to Gamow's calculations [Abstr. 408 (1949)] are reported. It is now found necessary to consider the curvature term in calculating the time at which $\rho_{mat} = \rho_{rad}$. The corrected condensation-mass is not much different from the original estimate. R. A. N.

523.12 : 523.877

410. The expanding universe and the theory of energy generation in stars. SCHATZMAN, É. *Ann. Astrophys.*, **10** (*No.* 1) 14–18 (1947) *In French.*—Predictions from the theory of an expanding universe can be made, compatible with Hubble's relation between nebular counts and luminosities, if it is assumed that the luminosities decrease with time; it is then unnecessary to introduce the world-curvature term. The required diminution of luminosity with time might arise from the evolution of giants into dwarf stars. R. A. N.

523.165 : 523.854

411. A new intense source of radio-frequency radiation in the constellation of Cassiopeia. RYLE, M. AND SMITH, F. G. *Nature, Lond.*, **162**, 462–3 (*Sept.* 18, 1948).—A new source of radio-frequency radiation in the constellation Cassiopeia is more intense and less variable than that known to exist in Cygnus. The intensity of the new source is given as 23×10^{-23} W/m²/(c/s) compared with 14×10^{-2} W/m²/(c/s) observed for the source in Cygnus. The discovery of several minor sources having intensities smaller than that in Cygnus is also reported—one in Ursa Major shows a maximum intensity of 5×10^{-23} W/m²/(c/s). Unlike r.f. radiation from sun spots this galactic radiation is randomly polarized, suggesting that the mechanism of production may be different and may not involve an appreciable magnetic field in the emitting region. W. J. G. B.

523.165 : 523.854

412. Origin of fluctuating galactic noise. MINNAERT, M.; RYLE, M. AND SMITH, F. G. Letters in *Nature, Lond.*, **162**, 858–9 (*Nov.* 27, 1948).—It is pointed out that the observation by Ryle and Smith [see Abstr. 411 (1949)] of a variable unpolarized noise radiation from the galactic source Cassiopeia gives no evidence against an origin similar to that responsible for solar "bursts" since there is experimental evidence that such solar bursts are also unpolarized.

Ryle and Smith, in reply, state that their observations on the steady component of the noise radiation from Cassiopeia and Cygnus suggest that this is produced by a mechanism similar to that of the thermal radiation from the quiet sun, and add that in their view there is as yet insufficient evidence that solar bursts are unpolarized. W. J. G. B.

523.25 : 523.4

413. Types of satellite systems and the disc theory of the origin of the planetary system. BERLAGE, H. P. *Proc. K. Ned. Acad. Wet.*, **51** (*No.* 8) 965–8 (1948) *In English.*—The disc theory is applied to satellite systems, which are assumed to have developed in the same way as planetary systems [see Abstr. 498 (1948)]. In general there will be a condensation of more than one satellite around a primary; the systems Earth–Moon and Neptune–Triton are studied as special cases. It is concluded that the Moon has receded from the Earth and that Triton has approached Neptune since formation. R. A. N.

523.49.481

414. Tables of Uranus for the period from 4000 BC to 3000 AD. KAMIEŃSKI, M. AND WALTER, R. *Bull. Int. Acad. Polonaise Sci. Lett. A* (*Nos* 1–3) 15–47 (*Jan.–March*, 1947) *In English.*—Gaillot's tables are used to construct a simplified set suited for the rapid computation of the heliocentric co-ordinates with accuracy ~1′. An illustrative computation is given. R. A. N.

523.5 : 519.2

415. Probability that a meteorite will hit or penetrate a body situated in the vicinity of the earth. GRIMMINGER, G. *J. Appl. Phys.*, **19**, 947–56 (*Oct.*, 1948).—When a body is situated at sufficiently great altitudes (~ 200 km or above) it is exposed to impact by the meteorites which enter the earth's atmosphere. A preliminary attempt is made to estimate the probability that a body situated in the vicinity of the earth will be hit by a meteorite and, when hit does occur, to estimate the metal plate thickness necessary to prevent perforation by the impact of meteorites of different sizes. For stainless steel skin thicknesses ranging from 0·05 to 0·02 in it is necessary to consider meteorites as small as those corresponding to magnitude 8 to 11, respectively. In general, however, it is

found that for meteorites which are large enough to present a perforation hazard the probability of a hit is negligibly small, particularly if the body is not exposed to meteoric impact for excessively long periods of time. A.

523.5 : 537.591

Rate of production of helium in meteorites by cosmic radiation. *See Abstr.* 617

523.63

416. The motion of comet Olbers 1815–1956. RASMUSEN, H. Q. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **24** (*No.* 18) 66 *pp.* (1948) *In English.*—This comprehensive re-discussion of the orbit of this important comet, first observed in 1815 by Olbers, Gauss and others, removes all discrepancies between observation and calculation. The author repeats corrections to Ginzel's 1887-elements, taking into account all planetary perturbations, until a set of elements is attained whose ephemeris agrees with the 1815-observations within $\pm 15''$, i.e. within the magnitude of uncertainty of these observations. Some 250 integration intervals were used. With these improved elements the motion of the comet is investigated up to June 16, 1956, and a search ephemeris is given for this forthcoming apparition. It is shown that the 1887 period of 72·4 years will have changed to 69·6 years in 1956, and that this was mainly caused by a close approach of the comet to Jupiter (to only 1·5 astron. units) in January 1889. A. B.

523.63

417. The motion of comet Schwassmann–Wachmann 2 in the years 1942–1949. RASMUSEN, H. Q. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **25** (*No.* 2) 9 *pp.* (1948) *In English.*—The perturbed co-ordinates of this comet, allowing for Jupiter and Saturn and based on its 1929 orbital elements, have now been computed for 20 yr. During this time the comet, which was rediscovered in 1941 and again found in 1947, has made three revolutions. The differences between computed and observed positions are less than 1′ and the author concludes that the orbit will not deviate much for several further revolutions. A. B.

523.67

418. On the possibility of the presence of OH^+ bands in cometary spectra. HERMAN, R. *C.R. Acad. Sci., Paris*, **227**, 962–4 (*Nov.* 8, 1948) *In French.*—The contribution of OH^+ to the "4050" band in cometary spectra is not confirmed by laboratory investigation. Its presence is possible, but is masked by other stronger bands in the regions which could be investigated. D. L. E.

523.72 : 537.591.5

419. Cosmic rays from the sun. EHMERT, A. *Z. Naturforsch.*, **3a**, 264–85 (*May*, 1948) *In German.*—Continuous records of cosmic-ray intensity at Friedrichshafen, using a twofold Geiger counter telescope array, are described for the years 1941 to 1943, and sudden variations of intensity are discussed. The variations are related to solar activity, and on certain occasions are compared with similar records from other stations. J. G. W.

523.746 : 523.72 : 621.396.82

420. Bursts of solar noise at 45 Mc accompanying the large sunspots of 1947. STETSON, H. T. *Science*, **108**, 354–5 (*Oct.* 1, 1948).

523.75

421. On the asymmetry of the distribution of chromospheric eruptions. LINK, F. AND KLECZEK, J. *C.R. Acad. Sci., Paris*, **227**, 827–8 (*Oct.* 27, 1948) *In French.*—The active regions of the sun, in which eruptions were observed in the period 1935–1947, are divided into three groups (A: 1–4 eruptions during the 13 days of visibility; total 1930. B: 5–9; 1175. C: more than 9; 2342). Quantities representing intensity, duration and minimum energy emitted are collected for all eruptions in 10° wide longitude-belts. When quotients E/W are formed from these quantities, to characterize the relative distribution in East and West with reference to the centre of the disc, maxima of 1·42, 1·58 and 1·90, respectively, are apparent at 45° longitude in all three groups, thus indicating a definite asymmetry. An attempt to explain this by terrestrial influences on the sun is put forward as a tentative hypothesis. A. B.

523.77 : 551.510.4

422. Telluric bands of methane in the Fraunhofer spectrum. MCMATH, R. R., MOHLER, O. C. AND GOLDBERG, L. Letter in *Phys. Rev.*, **73**, 1203–4 (*May* 15, 1948).—Direct-intensity tracings of high resolution solar spectra between 1 and 2·5 μ show a band system at 1·6660 μ attributed to atmospheric CH_4. In conjunction with Mageotti's observations in the 3·4 μ region the evidence seems conclusive for the existence of atmospheric CH_4. A detailed analysis of this band (to be published later) is in good agreement with theory. D. L. E.

523.821 : 522.982 : 522.983.1

423. The visibility of stars in the daylight sky. TOUSEY, R. AND HULBURT, E. O. *J. Opt. Soc. Amer.*, **38**, 886–96 (*Oct.*, 1948).—From the theory of the passage of light through a telescope and into the eye, formulae are derived for the improvement in the visual threshold of a point source viewed in a field of light (e.g. a star in the sky), in terms of telescope parameters (magnification, transmission and entrance and exit pupils). For fields of the brightness of the daylight sky the first parameter is the most important and the others are of less importance. Observations of artificial stars in the laboratory and of real stars in the daylight sky are given, which were in fair accord with the theory. Charts and tables are presented of the visual thresholds of stars in various parts of a clear daylight sky in terms of the stellar magnitude, the magnification of the telescope, the use of a polarizer, the altitude of the observer above the surface, and the altitude of the sun above the horizon. New data are given of extra-foveal thresholds of point sources in a field of brightness 360 ft-c^{-2}. A.

523.821.3 : 523.323.6 : 523.72

424. Astronomical photometric research at Pierre-à-Bot, 1945–6. DE SAUSSURE, M. *Arch. Sci. Phys. Nat.*, **29**, 239–61 (*July–Aug.*, 1947) *In French.*—Gives results of tests made using new methods for determining photographic magnitudes of stars. Results are also given for three lunar eclipses, during which the magnitude of the earth's shadow was determined. A series of observations to obtain values of the solar radiation is described, together with photometric work on the solar corona. Finally comparisons of the

brightness and colour of two planets, Mars and Saturn, are given. E. G. M.

523.85

425. New contributions to the study of spiral nebulae. FRICKE, W. *Naturwiss.*, **35** (*No.* 2) 52–8 (1948) *In German.*—Critical examination of the observational material used in important recent papers covering also the new state of nebular theory. Fricke deals with the work of Baade on the resolution of M31 and its companions [Abstr. 820–1 (1945)]; with the papers by Lindblad and Brahde [Abstr. 1409 (1947)], Seyfert [Abstr. 2377 (1940)] and Holmberg [*Medd. Obs. Lund* (*No.* 114) (1945)] on the distribution of stars and dark matter in the nebulae; by Hubble [Abstr. 1859 (1943)] on the sense of rotation of the spirals, which the author thinks opposite to the sense accepted by Lindblad and Brahde; by Babcock [Abstr. 1033 (1940)], on the dependence of the rotational velocity on the central distance; finally, with similar work done on M33 by Mayall and Aller [Abstr. 1216 (1942)] and by Wyse and Mayall [Abstr. 1214 (1942)]. A. B.

523.852.3

426. On a remarkable structural analogy between elliptic nebulae and extra-galactic nebular clusters. DE VAUCOULEURS, G. *C.R. Acad. Sci., Paris*, **227**, 586–8 (*Sept.* 20, 1948) *In French.*—The distribution of luminosity in elliptic nebulae is found to be well represented by $\log (B/B_e) = -A[(a/a_e)^{1/4} - 1]$, where $A = 3{\cdot}25$, B is the brightness along an elliptic isophote of major axis $2a$, and a_e is the "effective dimension" defining the ellipse enclosing $\frac{1}{2}$ of the total luminosity. A similar formula with $A = 3{\cdot}10$ is found to hold for the distribution of nebulae in a cluster, a_e now being the radius enclosing $\frac{1}{2}$ the total population of the cluster and B the nebular density at distance a from the centre. R. A. N.

523.852.32 : 523.874

427. Inclinations of spectrum lines in spirals. MAYALL, N. U. *Sky and Telescope*, **8**, 3–5, 17 (*Nov.*, 1948).—Rotation periods of 30 spiral nebulae are deduced from the inclinations of their spectrum lines combined with estimated distances based on red shifts. The results, shown diagrammatically, suggest a possible slight increase of period with advancing nebular type (in Hubble's classification), but no connection with absolute magnitude. D. L. E.

523.854.23

428. New researches on the constitution of the galactic system. ARMELLINI, G. *Comment. Pont. Acad. Sci.*, **8** (*No.* 16) 461–84 (1944) *In Italian.*—The local system is regarded as a satellite of the main galactic system, and the observed variations with galactic longitude of the velocities of stars in the local system are obtained as the result of perturbations arising from the attraction of the main system. The local system is assumed to be a flattened ellipsoid whose equatorial plane contains the galactic centre. The mass of the local system is found to be $\sim 10^8$ solar masses, and its angular velocity about its polar axis $\sim 0{\cdot}00056''$ per year. The distance of the galactic centre, and the mass of the main system are found to be $\sim 14\,500$ parsecs and $2{\cdot}5 \times 10^{11}$ solar masses. R. A. N.

523.875 : 523.842

429. Giant binary stars and the mass-luminosity law. HYNEK, J. A. Letter in *Nature, Lond.*, **162**, 815–16 (*Nov.* 20, 1948).—From consideration of the observed mean values of the trigonometric, dynamic and spectroscopic parallaxes of giant binaries, it is concluded that the primary components lie above the ordinary giant sequence, and are sub-luminous for their masses. R. A. N.

523.875 : 523.842 : 523.877

430. Mixed types of stellar populations. GAMOW, G. Letter in *Nature, Lond.*, **162**, 816 (*Nov.* 20, 1948).—It is suggested that the slow-moving red giants considered by Hynek [see Abstr. 429 (1949)] may have the physical characteristics of the high-velocity giants of Baade's population type II, thus forming a population of mixed type II_1. R. A. N.

523.877 : 539.17

431. Thermo-nuclear reactions at high densities. (Degenerate and non-degenerate gas.) SCHATZMAN, E. *J. Phys. Radium* (*Sér.* 8) **9**, 46–60 (*Feb.*, 1948) *In French.*—[See Abstr. 1758 (1948)]. The transparency of nuclear potential barriers at high densities is discussed, and the corresponding reaction rates for degenerate and non-degenerate nuclear gas are calculated. The effect of the increased reaction rates upon the constitution of very dense white dwarfs is discussed and is found to introduce no appreciable modification in the author's theory of supernovae. R. A. N.

523.877 : 539.185

432. A solution of Milne's problem by the variational method applied to an exponential expansion of the source function. KOURGANOFF, V. *C.R. Acad. Sci., Paris*, **227**, 895–7 (*Nov.* 3, 1948) *In French.*—Exact solutions [Abstr. 3667–8 (1947)] are used to compare the variational method [Abstr. 19 (1948)] with other approximate solutions. The variational method is found to be the more accurate for $\tau \geqslant 0{\cdot}1$. R. A. N.

525.73 : 551.593.5

433. Influence of the atmosphere upon the precision of telescope pointing. WASHER, F. E. AND SCOTT, L. W. *J. Res. Nat. Bur. Stand., Wash.*, **39**, 297–302 (*Oct.*, 1947).—The probable error of a single pointing (PE_s) was measured under conditions such that the effect of the air column intervening between observer and target was introduced or eliminated at will. The substantial reduction in PE_s for the method with air column eliminated as compared with the method with air column present showed that precision in outdoor pointing is definitely limited by the air column. Approximate computations showed that the value of PE_s cannot be appreciably reduced by increasing the magnification of the telescope above 20. A.

525.73 : 551.593.5 : 523.755

434. Researches on atmospheric diffusion and on solar radiation. FRACASTORO, M. G. *Ric. Sci. Ricostruz.*, **17**, 2012–16 (*Dec.*, 1947) *In Italian.*—Describes a survey of the light-scattering properties of the atmosphere in different localities considered as sites for making observations of the sun's corona. The instrument used compares the brightness of a small annulus of sky in proximity to the sun with that of a small portion of the sun's disc, the measurements being made with an uncorrected rectifier photocell. J. W. T. W.

PHYSICS 53

53

435. Reports from the conference of the Swedish National Committee for Physics in 1947. SIEGBAHN, M. AND HULTHÉN, E. *Ark. Mat. Astr. Fys.*, **34 A**, *Paper No.* 29, 20 *pp.* (1948) *In English.*—Programmes and results of research work carried out at different universities are presented.

53.084.875 : 53.083.3 : 621.317.727

436. An instrument for the rapid production of a decimal series of potentials and its application to ballistic measurements. ROBERTS, H. S. AND CURTIS, H. L. *J. Res. Nat. Bur. Stand., Wash.*, **41**, 45–51 (*July*, 1948).—Abstr. 127 B (1949).

53.087.62

437. Guide rod for ink styles. ZSCHOKKE, M. *Rev. Sci. Instrum.*, **19**, 552–5 (*Sept.*, 1948).—For recording instruments rectangular co-ordinates are preferred to curved ordinates. The article describes a method by which an arc, produced by an instrument's hand, can be converted into a straight line by means of a guiding device. It is also proved that any unavoidable aberration from the absolute straight line is of no consequence for the accuracy of the recorded measurement. A.

FUNDAMENTALS 530.1

530.1 : 537.11 : 538.1

438. The magnetic field produced by the rotation of a gravitating mass possessing a volume distribution of electric charge. ŞALCEANU, C. *C.R. Acad. Sci., Paris*, **227**, 624–6 (*Sept.* 27, 1948) *In French.*—The ratio of the magnetic moment to angular momentum for a uniform rotating sphere is shown to be $\frac{1}{2}$ the ratio of the total charge (e.m.u.) to the mass. Applications to the earth and to the electron are discussed. R. A. N.

530.1 : 538.1 : 531.15

439. The magnetic field of a rotating mass. PROCOPIU, S. *Bull. École Polyt. Jassy*, **3**, 453–8 (*Jan.–June*, 1948) *In French.*—Dimensional considerations are used to suggest that the ratio of the magnetic moment to angular momentum is equal to the ratio of the electric charge (e.m.u.) to the mass. It is suggested that the volume charge density is the same for all rotating masses, and that the reciprocal mass density corresponds to the coefficient β in Blackett's formula [Abstr. 1715 (1947)]. The new relation is applicable to the electron as well as to celestial bodies. R. A. N.

530.12 : 530.145.6

440. Relativistic wave-equations. WIGNER, E. P. *Z. Phys.*, **124** (*Nos* 7–12) 665–84 (1948) *In German.*—The relativistic one-body problem may be treated in 2 ways. Relativistically invariant linear equations may be set up and the solutions of these form a manifold, M, which represents the possible states of the system. Alternatively, M may be determined directly, and this process is considered in the present paper. In the case of a finite mass the manifold obtained is one for which Majorana gave equations. The manifold for vanishing rest mass cannot be obtained from this simply by a limiting process. It contains infinitely many polarization states. These are investigated. L. S. G.

530.14 : 539.152.1

441. The capture of mesons. BRUNO, B. *Ark. Mat. Astr. Fys.*, **36 A**, *Paper No.* 8, 44 *pp.* (1948) *In English.*—The final stage of capture of a negative meson into a nucleus is considered in terms of the transformation proton to neutron, without emission of radiation or neutral particle, for a meson of integral spin. Attention is drawn to the large uncertainties involved, and it is concluded that these may be sufficient to bring the result of the calculation for scalar mesons (but probably not for vector or pseudo-scalar mesons) into agreement with experiment. J. G. W.

530.145

442. Recent progress of quantum theory of fields and of the meson. MANNEBACK, C. *Rel. Pont. Acad. Sci.* (*Auct. Sci. Temp. Belli*) (*No.* 17) 21 *pp.* (1939–45) *In French.*—Survey of work 1939–46 in European countries; 18-page bibliography with abstracts.

530.145

443. The proper field and the interaction of Dirac particles. III. PIRENNE, J. *Arch. Sci. Phys. Nat.*, **29**, 265–300 (*Sept.–Dec.*, 1947) *In French.*—For previous work see Abstr. 2707–8 (1948). The electron-positron system is now studied. Wave-functions and levels are investigated according to Pauli's theory. The fine structure of the levels is discussed. The possibility of annihilation and re-creation of the electron-positron pair leads to a new type of interaction and this is analysed in considerable detail. L. S. G.

530.145

444. Superquantization. I. GROENEWALD, H. J. *Proc. K. Ned. Akad. Wet.*, **51** (*No.* 8) 977–89 (1948) *In English.*—The various types of quantization are reviewed, and the relationship of superquantization to these is discussed. Two types of theories are based on superquantization. These are: (1) Dirac's hole theory (half-odd spin) and Pauli–Weisskopf theory (integer spin); (2) Dirac's 1942 theory. The author's aim is to show that these 2 types are isomorphic. The basic details of superquantization are formulated for use in later papers. L. S. G.

530.145 : 535.14 : 538.3

445. New aspects of the photon self-energy problem. WENTZEL, G. *Phys. Rev.*, **74**, 1070–5 (*Nov.* 1, 1948).—A finite but non-vanishing value for the self-energy of the photon, corresponding to a finite rest-mass, can be deduced from the new invariant formulation of quantum electrodynamics developed by Tomonaga and Schwinger, in the ε^2 order approximation. The implications of this result are discussed. A.

530.145 : 537.133 + 539.185

446. On the electromagnetic self-energy of protons and neutrons. RADICATI, L. A. Letter in *Nuovo Cim.*, **5**, 513–14 (*Oct.*, 1948) *In Italian.*—For particles with anomalous magnetic moment (proton, neutron), a

modified Dirac equation leads to additional infinities in the self-energy besides the usual ones present in the case of the electron. The author shows that these additional diverging terms may be eliminated by means of Dirac's λ-limiting process. L. P.

530.145 : 539.18

447. On the mass-spectrum of mesons. IZMAILOV, S. V. *Dokl. Akad. Nauk SSSR*, **58** (*No.* 6) 1019–22 (1947) *In Russian.*—The mass spectrum of mesons is assumed to be connected with the existence of internal excited states of one or more (scalar, pseudoscalar and vector) types of mesons, in particular, the internal excitation to be connected with the production of "internal rotational movement." On the classical relativistic Hamiltonian H of a spherically symmetrical particle an expression is derived for the mass of the meson and therefrom an expression for the mass spectrum of the mesons. An equation for the life of scalar and pseudoscalar mesons is considered and the following hypothesis is meant to resolve the contradictions between this equation and Rossi's experimental data [Abstr. 735 (1943)]. Though the hard component contains mesons in different excited states, only those mesons decompose which are in a normal state, so that mesons must lose this excitation energy before they can decompose spontaneously. Lastly it is observed that the existence of a mass spectrum of mesons should be reflected in nuclear forces. W. H.

530.145.163 : 537.11

448. The polarisation of the vacuum. ŢIŢEICA, Ş. *Bull. Soc. Roumaine Phys.*, **43** (*No.* 80) 55–64 (1942) *In French.*—The polarization of the vacuum is defined as the difference between the probability density matrices of the occupied positive and the unoccupied negative energy states of Dirac's electron theory. This expression for the polarization of the vacuum is not completely determined. In a previous paper [see Abstr. 451 (1949)] the author proposed a method for the unique determination of the density matrix, using an artifice first introduced by Hadamard. If this method is adopted, the polarization of the vacuum vanishes. Thus no linear modification of Maxwell's equation arises when positrons are regarded as unoccupied negative energy states. H. MO.

530.145.6 : 537.591

449. An extension of the theory of particles of spin ½ allowing the representation of a meson with many mass states. PETIAU, G. *C.R. Acad. Sci., Paris*, **227**, 825–7 (*Oct.* 27, 1948) *In French.*—The meson equations of Potier [Abstr. 2016 (1948)] are obtained by combining two Dirac equations of particles of spin ½ but different masses, and modifying them in a way similar to that due to van Isaker. G. J. K.

530.145.61/.63 : 537.533.74

450. Scattering of fast electrons by nuclei. URBAN, P. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 6–7) 557–64 (1943) *In German.*—All present formulae for the scattering of fast electrons by nuclei have a common flaw: the higher approximations become divergent when approaching the naked nucleus. Starting with the solution due to Sauter [Abstr. 1324 (1934)] the author derives higher approximations according to the Dirac theory. The formulae again become divergent; the basic approximation is therefore unreliable. The connection is established between the solution obtained by the Dirac and the Schrödinger method which also becomes divergent. V. W. R.

530.145.63 : 537.1

451. Contributions to positron theory. I. ŢIŢEICA, Ş. *Bull. Soc. Roumaine Phys.*, **41** (*No.* 76) 47–68 (1940) *In French.*—A study of difficulties arising in Dirac's hole theory of the positron where arbitrary terms of the probability density matrix have to be eliminated by subtraction rules. Attention is drawn to general results due to Hadamard concerning the hyperbolic type of partial differential equations of the second order according to which there is a distinction between equations with an odd or even number of independent variables. Certain solutions, termed elementary solutions, are uniquely determined by their singularities in $2\gamma + 1$ dimensions while this is not so in 2γ dimensions. However, according to a procedure also due to Hadamard, termed *descent*, solutions in 2γ dimensions can be uniquely defined by passing from a $2\gamma + 1$ to a 2γ-dimensional solution. The author applies the method of descent to the determination of the probability density matrix of Dirac's theory which corresponds to Hadamard's elementary solution. The result obtained in the field-free case corresponds to Dirac's and not to Heisenberg's choice. A procedure for determining the probability density matrix in the presence of fields and an explicit expression for it are also given. H. MO.

530.145.63 : 537.1

452. Contributions to positron theory. II. ŢIŢEICA, Ş. *Bull. Soc. Roumaine Phys.*, **42** (*No.* 77) 3–8 (1941) *In French.*—In a previous paper [see Abstr. 451 (1949)] the author discussed the question of uniqueness of the probability density matrix arising in Dirac's theory of the electron and positron. Mathematical methods due to Hadamard were applied to the problem. These methods are now used to treat Cauchy's initial value problem as formulated for Dirac's wave equation. The results are transcribed in terms of the more usual δ-function symbolism. Commutation relations analogous to those of Jordan and Pauli's quantum electrodynamics are found [*Z. Phys.*, **41**, 151 (1927)]. H. MO.

530.145.6

453. A general theory of corpuscles and corpuscular systems and its applications. MURARD, R. *Ann. Phys. Paris* (*Sér.* 12) **3**, 550–619 (*Sept.–Oct.*, 1948) *In French.*—At first the theory of a free particle is considered with reference to J. L. Destouches' particle theory, which is then shown to be capable of solving the said problem, i.e. of determining the requisite wave equation and characteristic properties of the particle, in particular, its spin. The second part deals with corpuscular systems, again in the way pointed out by Destouches. The necessary improvements are shown, leading to the determination of the interaction operator of the system considered. Certain results are derived referring to the theory of "fused systems" (e.g. 2 Dirac particles the relative movement of which vanishes for any observer, compared with the movement of their common C.G.), and to a single particle in an external field.

GENERAL MECHANICS . MECHANICS OF SOLIDS 531

531.01 : 530.1

454. Rational mechanics and mathematical physics in central and southern Italy from 1939 to the present. SIGNORINI, A. *Rel. Pont. Acad. Sci.* (*Auct. Sci. Temp. Belli*) (*No.* 15) 15 *pp.* (1939–45) *In Italian.*—Review, including bibliography of 11 pages.

531.01 : 530.1

455. Rational mechanics and mathematical physics in N. Italy and Switzerland from 1939 to 1945. SOMIGLIANA, C., FINZI, B. AND CATTENEO, C. *Rel. Pont. Acad. Sci.* (*Auct. Sci. Temp. Belli*) (*No.* 18) 19 *pp.* (1939–45) *In Italian.*—Review, including bibliography of 13 pages.

531.1

456. Gyroscopic character deriving from sufficiently large initial values of the ignorable velocities. TEOFILATO, P. *Acta Pont. Acad. Sci.*, **8** (*No.* 19) 157–75 (1944) *In Italian.*—With a suitable choice of initial conditions (e.g. assuming that the ignorable velocities are large), the apparent velocities may remain in absolute value as small as desired. This condition gives the motion a gyroscopic character. L. P.

531.19

457. On a simple method for calculating distribution functions. LEIBFRIED, G. AND KAEMPFFER, F. *Z. Phys.*, **124** (*Nos* 7–12) 441–9 (1948) *In German.*—A method is described for calculating the distribution function of the Bose statistics of a degenerate system. The method is elementary but equivalent to the usual method of steepest descent. Boltzmann-statistics are also discussed and the variation of specific heat with temperature is investigated. Some remarks are made concerning the Einstein-condensation of an ideal gas. L. S. G.

531.19 : 536.7

458. On the statistics of classical systems. SCHLÜTER, A. *Z. Naturforsch.*, **3a**, 350–60 (*June*, 1948) *In German.*—The phase volume and phase density of a system are defined. Assuming the ergodic hypothesis, the phase density is expressed as the *faltung* product of the phase densities of the single particles. Explicit results are obtained for "classical" particles and an example, relating to an ideal gas, is given. The statistics and thermodynamics of systems of "classical" particles are investigated. L. S. G.

531.224.8

459. Asymptotic behaviour of a thin clamped circular plate under uniform normal pressure at very large deflection. CHIEN, W. Z. *Sci. Rep. Nat. Tsing Hua Univ.*, **5**, 71–94 (*April*, 1948) *In English.*—The problem stated is solved by a method of successive approximations. The fundamental solution chosen is that due to Hencky which satisfies all conditions for a clamped edge except two. This solution gives satisfactory values for the middle of the plate but fails at the boundary region. Thereafter the process employed is to introduce by successive approximations circumferential and radial stresses in order to obtain a solution satisfying the two remaining boundary conditions. Results obtained by calculation for a given load are in agreement with experimental results given by McPherson, Ramberg and Levy, N.A.C.A. Report No. 744. G. G.

531.252

460. Stress functions of the three-dimensional continuum. WEBER, C. *Z. angew. Math. Mech.*, **28**, 193–204 (*July–Aug.*, 1948) *In German.*—The conditions of equilibrium in a three-dimensional medium are satisfied by stresses obtained from the second derivatives of certain stress functions that are investigated in the report. The functions always form a tensor. For a given stressed state, it is possible to find different functional tensors, the difference of which has the character of a distortion tensor. A.

531.396 : 521.13 : 517.948.33

461. New content of the multi-particle problem. VLASOV, A. A. *J. Exp. Theor. Phys.*, **18**, 840–56 (*Sept.*, 1948) *In Russian.*—(1) Theory of the method; (2) stationary conditions as eigen-value problem of non-linear integral equations; (3) spectrum of the linearized equations; (4) general principles of the branched solutions; (5) branching-off of solutions from the trivial solution; (6) branching-off of solutions from the periodic solution; (7) special (particular) solutions. A.

MECHANICAL MEASUREMENTS 531.7

531.717 : 537.531

462. X-ray measurement of the thickness of thin films deposited on microcrystalline supports. LEGRAND, C. *C.R. Acad. Sci., Paris*, **227**, 831–3 (*Oct.* 27, 1948) *In French.*—The method of Friedman and Birks [Abstr. 1801 (1946)] is modified to avoid the necessity of constant tube output. Two reflections from the support are measured, the angle of incidence of the X-ray beam being chosen so that one emerges at a small angle α_1 ($\sim 3°$), the other at a larger angle α_2. If the ratio of the intensities for the bare support is R and for the coated support is R', the thickness ε is given by $\mu\varepsilon(\sin\alpha_2 - \sin\alpha_1)/\sin\alpha_1 \sin\alpha_2 = \log R/R'$, where μ is the linear absorption coefficient of the coating. A. J. C. W.

531.717.1 : 621.317.49

463. Magnetic measurement of the thickness of composite copper and nickel coatings on steel. BRENNER, A. AND KELLOGG, E. *J. Res. Nat. Bur. Stand., Wash.*, **40**, 295–9 (*April*, 1948).—Abstr. 429 B (1949).

531.719.33 : 629.135 : 621.317.39

464. A direct-capacitance aircraft altimeter. WATTON, W. L. AND PEMBERTON, M. E. *Instn Elect. Engrs, Paper No.* 743, 8 *pp.* (*Nov.*, 1948).—See Abstr. 421 B (1949).

531.758.1 : 681.26

465. Quartz spring Joly balance. SHEFT, I. AND FRIED, S. Letter in *Rev. Sci. Instrum.*, **19**, 723–4 (*Oct.*, 1948).

531.787

466. A sensitive mercury manometer. PUDDINGTON, I. E. *Rev. Sci. Instrum.*, **19**, 577–9 (*Sept.*, 1948).—A mercury manometer, of the U-tube type, in which the volume of Hg which flows between the arms when

a pressure is applied can be measured precisely, is described. The arms of the U-tube are made in the form of large diameter, shallow cylinders to give a large flow of Hg for a relatively small pressure change. The flow is measured by determining changes in the volume of Hg in one arm of the manometer. This is done by isolating that arm through the closure of a stopcock contained in the small-bore tubing which connects the two arms, and adjusting the level of the Hg to an etch in a capillary; the volume change is then read directly from the position of the end of the Hg thread in a second capillary. The magnification of a pressure change is ½ the ratio of the cross-sectional areas of the U-tube cylinder and the capillary on which the volume change is noted. Magnifications as high as 4 000 have been obtained with this device. A.

531.787 : 535.415

467. Dynamic pressure measurement by optical interference. BUCK, W. E. AND BARKAS, W. H. *Rev. Sci. Instrum.*, **19**, 678–84 (*Oct.*, 1948).—A pressure gauge is described in which the displacement of a pressure diaphragm is measured by recording photographically the motion of interference fringes formed by light reflected from the diaphragm and from an adjacent stationary mirror. The instrument is simple and unusually accurate and stable. Typical observed performance: frequency range, 0 to $> 10^4$ c/s; pressure range, 0 to 5×10^3 lb/in²; absolute error, $< \frac{1}{2}\%$. Calibration is carried out under static conditions and the response is linear. Presentation of the data is direct and the analysis of the records simple. Other broad fields of application of the new recording principle are indicated. A.

MECHANICS OF FLUIDS 532

532.517.4 : 532.542.4

468. A kinetic theory of turbulence. DJANG, G.-F. *Chin. J. Phys.*, **7**, 176–91 (*June*, 1948) *In English.*—A theory of turbulent flow is developed on the basis of analogy between the motion of fluid particles in turbulent flow and that of individual molecules in a gas. Such an analogy exists between Prandtl's "mixing length" and the mean free path of kinetic theory. The analogy is here extended to include parameters of turbulent motion equivalent to temperature, pressure and entropy. The "turbulence temperature" T is defined by the equation $T = \bar{u}^2\lambda^2/\nu^2$, where $\bar{u}^2$ is the mean square of the velocity fluctuations at a point, λ is a characteristic dimension specifying the size of a "turbulence particle" and ν is the kinematic viscosity. The theory is applied to flow through a circular pipe; it is found that the turbulence temperature is uniform over the cross-section and that the theoretical velocity distribution agrees with experiment. Similar agreement also exists for flow between parallel planes and for turbulence decay in the wake of an obstacle. A. SCH.

532.517.4 : 532.7

469. On the statistical theory of turbulence. HEISENBERG, W. *Z. Phys.*, **124** (*Nos* 7–12) 628–57 (1948) *In German.*—Following on the work of Taylor [Abstr. 953 (1938)] the results of v. Weizsäcker are developed by means of Fourier expansions. By suitable approximations and graphical methods the diameters of the smallest turbulence elements are estimated and the spectral energy distribution for the smallest wavelengths is obtained. Expressions for the energy losses and the correlation function are deduced. E. H. D.

532.517.4 : 533.6.011.3

470. On velocity correlations and the equations of turbulent vorticity fluctuation. CHOU, P. Y. *Sci. Rep. Nat. Tsing Hua Univ.*, **5**, 52–70 (*April*, 1948) *In English.*—Three assumptions are introduced into the theory of turbulent motion; two with reference to double and triple velocity correlations between neighbouring points, and one with reference to average energy flux in a given direction. With the aid of these assumptions the necessary equations are obtained to determine the components of Reynolds stress, and the usual equations of mean motion in turbulent flow, and also to determine the laws of decay of energy and of vorticity in isotropic turbulence. The theory is applied to the case of flow within a channel to obtain the equation of energy transport and of vorticity decay, also equations indicating the values of mean squares of velocity fluctuation with distance from the centre of the channel. Results are in qualitative agreement with the existing experimental data. G. G.

532.574.5 : 533.6.08

471. A new apparatus for measuring velocities of flow of liquids and gases. GHEORGHIU, V. G. *Bull. École Polyt. Jassy*, **3**, 277–84 (*Jan.–June*, 1948) *In French.*—An anemometer, comprising a light sphere supported by a horizontal wire passing through its centre within a light circular framework which is supported above and below by suspension wires carrying springs of strength appropriate to the flows to be measured, is described. The relation between the velocity of flow and compression of the control springs is approximately linear, which is an advantage the scale of this anemometer has over the scale of the pendulum type of instrument. J. S. G. T.

532.58 : 534.222.2

472. On the determination of the pressure distribution on the flat surface of a shell. SLEZKIN, N. A. *C.R. Acad. Sci. URSS*, **54** (*No.* 7) 579–81 (1946) *In French.*—Reynolds' equations are written down and solved for a thin layer between the surface of the shell and the surface of the shock wave. From these an equation, of Bessel's type, is derived for the pressure. The final formula for the pressure is found in terms of Bessel functions of the second kind. L. S. G.

532.593 : 551.46.018.9

473. An instrument for recording ultra low frequency ocean waves. MUNK, W. H., IGLESIAS, H. V. AND FOLSOM, T. R. *Rev. Sci. Instrum.*, **19**, 654–8 (*Oct.*, 1948).—An instrument has been designed to measure low amplitude waves whose frequencies fall between those of the wind-generated ocean swell and those of the astronomic tides. Its maximum sensitivity is to waves whose period is 15 minutes, and its pass band extends approximately from 2-minute periods to 2 hours. The suppression of the ocean

swell and tides (whose amplitudes are much greater than those of the waves to be studied) is accomplished by means of capillaries and air chambers which give the instrument a response characteristic analogous to that of an electrical RC circuit. Records obtained show the continual presence of waves in this previously unexplored portion of the spectrum of gravity waves in the sea. A.

532.595 : 591.112

474. A note on the mathematical theory of vibrations of walls of blood vessels. RASHEVSKY, N. *Bull. Math. Biophys.*, **9**, 123–6 (*Sept.*, 1947).—The vibrations are studied by assuming the blood to be an ideal fluid. The solution obtained is more exact than the approx. solution found earlier [Abstr. 2054 (1945)] in which a viscous fluid was taken. Only axially symmetric deformations of the blood vessel are considered. L. S. G.

CAPILLARITY 532.6

532.613.5 : 541.183 : 536.71

475. Thermodynamic considerations on the interface equilibrium. GUMIŃSKI, K. *Bull. Int. Acad. Polonaise Sci. Lett. A* (*Nos* 1–3) 5–14 (1947) *In English.*—Theoretical study of conditions at boundary between a liquid and its boundary phase. Shows that non-electrolytes and weak electrolytes are positively adsorbed at a medium of lower dielectric constant; strong electrolytes are positively adsorbed at a medium of greater dielectric constant. The behaviour is shown to be consistent with the Kamienski theory of surface tension. N. C.

KINETIC THEORY OF LIQUIDS 532.7

532.7

476. The liquid state. Position of the problem in the various countries since 1936 until 1945. VAN HOOK, A. *Rel. Pont. Acad. Sci. (Auct. Sci. Temp. Belli)* (*No.* 6) 19 *pp.* (1939–45) *In English.*—Review, including bibliography of 7 pages.

532.712

477. Effect of chain branching on the osmotic pressure of solutions of high polymers. KUNST, E. AND MAGAT, M. *C.R. Acad. Sci., Paris*, **227**, 902–4 (*Nov.* 3, 1948) *In French.*—A formula is derived thermodynamically for relating osmotic pressure with the chain branching of high polymers, which, when the experimental data are introduced, is found to afford a method of deriving degree of branching within the limits of experimental error. H. H. HO.

532.74

478. The atomic distribution in liquid In, Tl and Pb. GLOCKER, R. AND HENDUS, H. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 6–7) 513–19 (1943) *In German.*—The atomic distribution of liquid In, Tl and Pb was found by Fourier analysis of interference photos with monochromatic X-rays. They only show 8-atom co-ordination, though when solid they show approx. closest atomic packing possible (i.e. 12-atom co-ordination). This disproves the theory that metals tend to assume the closest possible atomic distribution when melted, and also the theory that the average atomic distribution over an extremely small region of a liquid element is identical with that of the solid crystal. V. W. R.

MECHANICS OF GASES 533

533.15 : 537.323 : 541.135.86

479. Thermal diffusion and heat of transfer in condensed phases. WIRTZ, K. *Z. Phys.*, **124** (*Nos* 7–12) 482–500 (1948) *In German.*—The important quantity determining thermal diffusion and thermal-diffusion potentials (homogeneous thermoelectric effect) is the "heat of transfer" Q^*, the net energy carried by one mole of the diffusing substance. The material flow may be either down or up the temperature gradient, depending on whether Q^* is positive or negative. The Soret coefficient (fractional change in concentration per degree temperature difference) is $-Q^*/RT^2$. In equilibrium the thermal-diffusion potential is $dV/dT = -Q^*/FT$, where F is the charge carried per mole. Measurements ordinarily give only the difference between Q^*'s for two ions, but plausible arguments suggest that for Li^+ in dilute solution $Q^* = 0$. On that assumption values for other ions are Na^+ 2·3, K^+ 2·6, Rb^+ 2·1, Zn^{++} 6·3, Ca^{++} 1·6, Cl^- 0, Br^- 0·4, I^- — 1·3, SO_4^- 4·5, in kcal/mole. A. J. C. W.

533.15/.16 : 536.23

480. The transport properties for non-polar gases. HIRSCHFELDER, J. O., BIRD, R. B. AND SPOTZ, E. L. *J. Chem. Phys.*, **16**, 968–81 (*Oct.*, 1948).—Chapman and Cowling have related the coefficients of viscosity, diffusion, thermal diffusion, and heat conductivity to a set of integrals, $\Omega_n^{(l)}(T)$ involving the law of force between pairs of molecules. The authors evaluated these integrals for $l = 1$, $n = 1, 2, 3$; $l = 2$, $n = 2, 3, 4, 5, 6$; $l = 4$, $n = 4$, assuming that the energy of attraction $\propto$ (separation)$^{-6}$ and the energy of repulsion $\propto$(separat.)$^{-12}$. This assumption is excellent for spherical non-polar molecules and a big improvement on the Sutherland assumption. The results are simple. The transport integrals are evaluated for all temperatures in terms of the maximum energy of interaction and the collision diameters. This gives a "corresponding states" relationship which should apply to extremely hot and extremely cold temperatures where good experimental data are not available. The molecular constants can be obtained very accurately from experimental viscosity data, and they agree with values previously obtained from equation of state data. A.

533.16 : 533.7

The volume viscosity of an ideal gas as a kinetic theory transport phenomenon. *See Abstr.* 490

533.5 : 537.734

481. A gas inlet leak for mass spectrometry. HARRIS, E. J. *J. Sci. Instrum. Phys. Ind.*, **25**, 417 (*Dec.*, 1948).

533.51/.56

482. A single-stage vapour vacuum pump. POLLARD, J., SUTTON, R. W. AND ALEXANDER, P. *J. Sci. Instrum. Phys. Ind.*, **25**, 401–3 (*Dec.*, 1948).—The principles of the design and details of the construction of a single-stage glycerol vapour pump of 3 in diameter are described. The pump, which is made of glass, has a maximum speed of 80 l/sec. The range of pressure over which it performs satisfactorily and its backing pressure requirements compare favourably with 2- and 3-stage pumps. A reason for the good performance of a single stage against high backing pressures is suggested.

533.56/.57

483. A comparison of mercury diffusion pumping speeds for five gases. FLUKE, D. *Rev. Sci. Instrum.*, **19**, 665–6 (*Oct.*, 1948).—Hg diffusion pumping speeds for H, He, air, A and Freon have been measured for a pump of small aperture and found to vary inversely as the square root of the molecular weight. A.

533.581

484. Metal-topped glass Dewars. ALLEN, J. F. *Rep. Internat. Conf.* "*Low Temperatures*" (1946) (*Phys. Soc., Lond*) *II*, 87–9 (1948).—Examples are given of the use of hardened compressed rubber rings for detachable joints in pumping lines, and for attaching a metal-topped Dewar to a pumping line. G. L. W.

533.6

485. Aerodynamics in Italy (from 1939 to 1945). PISTOLESI, E. AND FERRARI, C. *Rel. Pont. Acad. Sci.* (*Auct. Sci. Temp. Belli*) (*No.* 13) 45 *pp.* (1939–45) *In Italian.*—Review, including bibliography of 7 pages.

533.6.011

486. On the canonical form of the equations of steady motion of a perfect gas. MUNK, M. AND PRIM, R. C. *J. Appl. Phys.*, **19**, 957–8 (*Oct.*, 1948).—The equations for general steady motion of a perfect gas are expressed in terms of a reduced number of basic dependent variables. Neither constant entropy nor constant flow energy is assumed throughout the flow, but only along individual streamlines. The basic dependent variables used are the "reduced velocity" vector $\mathbf{w} \equiv \mathbf{v}\Big/\left(\frac{2\gamma}{\gamma-1}\frac{p}{\rho}+v^2\right)^{\frac{1}{2}}$ and the logarithm of the pressure, $\ln p$. The resulting form of the dynamic equation is $(\mathbf{w}\cdot\mathrm{grad})\mathbf{w}+\frac{\gamma-1}{2\gamma}(1-w^2)\,\mathrm{grad}\,\ln p=0$, and that of the continuity equation is $\mathrm{div}[(1-w^2)^{1/\gamma-1}\mathbf{w}]=0$, representing four equations in four unknowns. The fundamental characteristic and shock relations are also expressed in terms of these reduced variables. A.

533.6.011 : 532.542.1/.4

487. Hydraulic resistance of a layer of spherical particles in an isothermal or non-isothermal air flow. MULLOKANDOV, R. N. *J. Tech. Phys, USSR*, **18**, 1051–62 (*Aug.*, 1948) *In Russian.*—The problem has a bearing on the underground gasification of coal which was predicted as the method of the future by Mendeleev in 1888. A simple theory developed in parallel with the author's experiments yielded: (1) the critical Reynolds number from which on the laminar flow of the layer becomes turbulent, ~200, (2) the author's assumption of the intrinsic hydraulic difference of a flow with an undulating surface through pipes and in open conduits was confirmed by the results, (3) the hydraulic resistance obeys the same law whether the flow of air be isothermal or non-isothermal. A.

533.6.011 : 533.6

488. Cavity drag in two and three dimensions. PLESSET, M. S. AND SHAFFER, P. A., JR. *J. Appl. Phys.*, **19**, 934–9 (*Oct.*, 1948).—The free streamline theory has been applied to the computation of the cavity drag of symmetrical wedges of arbitrary angle. The drag coefficients and cavity widths and lengths are tabulated for a range of both cavitation parameter and internal angle. The pressure distributions computed for two-dimensional wedges have been taken to be approximately correct for cones of revolution of the corresponding internal angles. Under this assumption, drag coefficients for right circular cones of arbitrary internal angle have been computed and are tabulated for a range of both cavitation parameter and internal angle. A.

533.6.013.3

489. The flow of a compressible fluid past quasi-elliptic cylinders at high subsonic speeds. YUAN, S. *Sci. Rep. Nat. Tsing Hua Univ.*, **5**, 29–51 (*April*, 1948) *In English.*—According to Chalypin, if the stream function can be determined in any case of flow of an incompressible fluid past given boundaries, the corresponding stream function can be derived from it for compressible fluid flowing past the same, or slightly modified, boundaries. The limitations of the application of the method are discussed, and the method is applied to solve the problem of flow of compressible fluid along nearly elliptic boundaries. The solution obtained represents regular flow up to a certain critical value (0·61) of the main stream Mach number. Numerical values are worked out for a particular case of flow, and results are illustrated by graphs for elliptic and circular boundaries. G. G.

KINETIC THEORY OF GASES 533.7

533.7 : 533.16

490. The volume viscosity of an ideal gas as a kinetic theory transport phenomenon. KOHLER, M. *Z. Phys.*, **124** (*Nos* 7–12) 757–71 (1948) *In German.*—The macroscopic theory of fluid motion gives a stress tensor $p_{ij}=(p+\mu\ \mathrm{div}\ u)\delta_{ij}+\eta w_{ij}\eta$ (is the viscosity and w the shear tensor). The last term is $\propto$ to the rate of volume expansion. The volume viscosity μ vanishes for a monatomic gas but not for molecules unless the mean energy for each internal degree of freedom is $\frac{1}{2}kT$. A calculation of μ is made using the Chapman–Enskog method to first approximation, assuming that the molecules are perfectly elastic and rough spheres, with a parameter K, the ratio of the moment of inertia to that of a spherical shell, which indicates the distribution of mass. The result is $(\mu/\eta)=(9+13K)/60K$, shewing that μ is of the same order of magnitude as η. The consequences in

the propagation of sound and energy dissipation are discussed. G. J. K.

533.7 : 533.16 : 536.23

491. The viscosity and heat conductivity of gases with central intermolecular forces. DE BOER, J. AND VAN KRANENDONK, J. *Physica, 's Grav.*, **14**, 442–52 (*Sept.*, 1948) *In English.*—The coefficients of viscosity and heat conductivity have been calculated for gases, consisting of molecules which interact according to an intermolecular potential field of the form: $\phi(r) = 4\varepsilon[(\sigma/r)^{12} - (\sigma/r)^6]$. The results are given in reduced form so as to allow a comparison to be made with all substances for which the constants ε and σ of the intermolecular field are known. The results are in agreement with the available experimental data for Xe, A, Ne, H_2, D_2 and He. The deviations which appear for the light gases at low temperatures pointing to the necessity of applying quantum theory to the transport phenomena are discussed from a theoretical point of view and are compared with previous theoretical calculations of the transport phenomena based on quantum mechanics. A.

533.75 : 536.71 : 541.126

492. Fugacity determinations of the products of detonation. COOK, M. A. *J. Chem. Phys.*, **16**, 1081–90 (*Nov.*, 1948).—By employing the equation of state derived from the hydrodynamic theory and observed detonation velocities, the thermodynamic equilibrium constant $K_p(T)$ is derived in terms of the concentrations of the various gases comprising the products of detonation and the co-volume $\alpha(v)$, which may be evaluated for any known or assumed density of the products of detonation. A reiteration method is developed for solving simultaneously as many equilibria as is necessary to define completely the composition of the products of detonation. The application of the theory is illustrated by calculations for TNT which are compared with experimental data as well as results obtained from the approximate partial pressure method. Calculations are presented for several additional explosives. A.

VIBRATIONS . ACOUSTICS 534

534.014.2 : 517.942.1

493. Some observations on a particular type of permanent harmonic vibration. BENINI, A. *Acta Pont. Acad. Sci.*, **8** (*No.* 17) 141–8 (1944) *In Italian.*—Solution of the equation $a\ddot{y} + b\dot{y} + cy = k\omega^2 \sin \omega t$ is discussed. T. S. E. T.

534.222.1 : 534.321.9 : 548

494. Scattering of ultrasonic radiation in polycrystalline metals. ROTH, W. *J. Appl. Phys.*, **19**, 901–8 (*Oct.*, 1948).—A method for measuring absorption and velocity of ultrasonic radiation in the frequency range from 5 to 100 Mc/s by use of pulse techniques is described. Results of such measurements performed on polycrystalline Mg and Al as a function of frequency and grain size show that the absorption coefficient varies linearly with frequency and inversely with grain size. The scattering power of a metal, and the fidelity with which an ultrasonic pulse is transmitted, are shown to depend on the elastic constants of the single crystals. Criteria are established for evaluating the fidelity of pulse transmission in cubic and hexagonal metals, and figures of merit for many such polycrystalline metals are given. A.

534.222.1 : 539.215 : 548

495. Energy losses of sound waves in metals due to scattering and diffusion. MASON, W. P. AND MCSKIMIN, H. J. *J. Appl. Phys.*, **19**, 940–6 (*Oct.*, 1948).—When high-frequency longitudinal and transverse sound waves are sent through a multicrystalline rod of metal, attenuation losses result because of scattering and diffusion of sound waves by the grains. When the grain size is less than one-third of the wavelength, these losses are due to Rayleigh 4th-power law scattering and are proportional to the grain volume. The scattering factor depends on the anisotropy of the elastic constants. Two different factors are obtained, one for shear waves and one for longitudinal waves. These factors have been evaluated for cubic and hexagonal metals. From the measured elastic constants the only metals with a low loss are Al, Mg and W. The calculations indicate that the losses for Al and Mg are about equal for longitudinal waves, but for shear waves Mg has a very low shear loss. It has been found experimentally that Mg has nearly as low a loss as fused quartz. Experiments with higher frequencies show that when the wavelength is $\frac{1}{3}$ of the grain size or less, the transmission process becomes a diffusion process similar to the propagation of a heat wave. The grain sizes determine the mean free path, and the loss becomes $\propto$ (grain diameter)$^{-1}$. An approximate formula for diffusion losses has been obtained which agrees closely with the experimental values. A.

534.232 : 537.228.1

496. Some experiments on the use of $NH_4H_2PO_4$ crystals as ultrasonic generators. BÖMMEL, H. *Ric. Sci.*, **18**, 386–9 (*March–April*, 1948) *In Italian.*—Preliminary note.

534.232 : 537.228.1 : 621.396.611.21

497. Properties of ammonium phosphate crystals as ultrasonic generators. BÖMMEL, H. *Helv. Phys. Acta*, **21** (*No.* 5) 403–10 (1948) *In German.*—An account is given of the diffraction spectra obtained with a crystal of $NH_4H_2PO_4$ approx. 15 mm square and 1·71 mm thick, excited at frequencies ranging from 966 to 7 120 kc/s. The resonance curve, and Schlieren photographs taken at various frequencies, are given. H. J. H. S.

534.24 : 534.12

498. Interactions between a plate and a sound field. FAY, R. D. *J. Acoust. Soc. Amer.*, **20**, 620–5 (*Sept.*, 1948).—The paper deals with phenomena associated with the interactions between flexural vibrations in a plate and the sound field in an ambient fluid medium. An equation is developed in tractable form which determines the propagation function of the free and forced flexural waves which can exist under stated assumptions. It is found that the reaction of the fluid on the plate makes possible a wave which cannot exist in the free plate in steady state. For a steel plate in water, the potential effect of the additional wave is relatively great when the product of frequency and plate thickness lies between 6 and 20 kilocycle-in. A.

534.321.9

499. Some background history of ultrasonics. KLEIN, E. *J. Acoust. Soc. Amer.*, **20**, 601–4 (*Sept.*, 1948).—Ultrasonics was conceived and came into being in France in a wartime academic atmosphere. Its physical principles were explored in England and in U.S.A. during World War I. Piezoelectric quartz was for many years the only active transducer element utilized, but later synthetic Rochelle salt crystals were investigated and applied. Some theoretical work and several experimental techniques were developed in the U.S.A. concerning transducers. The subject of ultrasonics became dormant during the twenties. The Navy maintained an interest in ultrasonics and sponsored classified projects in the field. The subject of piezoelectricity was advanced, new synthetic crystals were brought forth, and large-scale processing, cutting, grinding and lapping of crystals were started and pursued by the Navy. An American version of the steel sandwich was produced for operational tests. The Pierce magnetostrictive devices were incorporated in sonar systems. Similarly the electrodynamic principle was implemented into a useful transducer. A variety of absolute and secondary standards was developed. A.

534.321.9 : 535.42

Some optical effects of ultrasonic waves. *See Abstr.* 549

534.321.9 : 620.179.16

500. Design and application of supersonic flaw detectors. ERDMAN, D. C. *Trans. Amer. Inst. Elect. Engrs*, **66**, 1271–6 (1947).—Abstr. 3 B (1949).

534.321.9 : 620.179.16

501. Physical principles of ultrasonics and its application to testing of materials. BAUD, R. V. *Schweiz. Bauztg*, **66**, 185–90 (*April* 3); 215–19 (*April* 17, 1948) *In German.*—See Abstr. 266 B (1949).

534.773.2 : 621.395.623

502. Models 65 and 66 hearing aids. POWER, J. R. *Bell. Lab. Rec.*, **26**, 30–3 (*Jan.*, 1948).—Abstr. 200 B (1949).

534.85 : 621.317.37 : 621.395.625

503. A study of frequency fluctuations in sound recording and reproducing systems. AXON, P. E. AND DAVIES, H. *Proc. Instn Elect. Engrs, Pt III*, **96**, 65–74 (*Jan.*, 1949).—Abstr. 536 B (1949).

534.862.2 : 621.395.623.7/.8 : 621.395.61

504. Electromechanical feedback. DE BOER, J. AND SCHENKEL, G. *J. Acoust. Soc. Amer.*, **20**, 641–7 (*Sept.*, 1948).—Abstr. 198 B (1949).

534.862.3 : 621.327.9

505. Sound film recording tubes. HARRIS, N. L. *Elect. Times*, **114**, 289–91 (*Sept.* 9, 1948).—See Abstr. 478 B (1949).

OPTICS . RADIATION . SPECTRA 535

535.1 : 530.12 : 531.18

506. Phase- and group-velocity. CARRARA, N. Letter in *Nuovo Cim.*, **5**, 515–17 (*Oct.*, 1948) *In Italian.*—A discussion of some consequences of Ditchburn's critical analysis of the negative result of the Michelson–Morley experiment [see Abstr. 179 (1948)]. L. E

535.135 : 517.948.3

507. On the propagation of light in a dispersive medium. LÉVY, M. *C.R. Acad. Sci., Paris*, **226**, 236–8 (*Jan.* 19, 1948) *In French.*—The integral equation determining the effective field acting on a molecule is solved rigorously. Only a summary of the calculation in the simplest case is given. L. P.

535.22

508. Constancy of the velocity of light and its verifications. SIVADJIAN, J. *Arch. Sci. Phys. Nat.*, **29**, 356–83 (*Sept.–Dec.*, 1947) *In French.*—Comprehensive historical survey with ample bibliography.

535.23 : 536.33

509. The efficiency of radiation shields. DE BARR, A. E. *Rev. Sci. Instrum.*, **19**, 569–73 (*Sept.*, 1948).—The effect of a number of thick radiation shields of infinite thermal conductivity and of a type realizable in practice is analysed by matrix algebra, and a method for calculating the temperatures of the various shields is also given. For identical thin shields it is found that the ratio of the power required to maintain a radiating surface of emissivity ε_0 at a given temperature with N shields to the power required to maintain the same temperature without shields is given by $[1 + \varepsilon_0(f + f^2 + f^3 + \ldots f^N)(1/\varepsilon_k + 1/\varepsilon_l - 1)]^{-1}$, where ε_k, ε_l are the emissivities of the two sides of a shield and f is the fraction of the radiation leaving the inside of the nth shield which is incident upon the $(n-1)$th shield. A.

535.23 : 536.33

510. Extension of De Barr's analysis of radiation shielding. GARRISON, J. B. AND LAWSON, A. W. *Rev. Sci. Instrum.*, **19**, 574–7 (*Sept.*, 1948).—De Barr [Abstr. 509 (1949)] has derived a formula for the efficiency of n thick radiation shields with infinite thermal conductivity and diffuse surfaces surrounding a black body source. This analysis has been extended to the general case when the original source has an arbitrary emissivity. A simple procedure for calculating explicitly the temperature of any shield is given, and simple numerical examples are cited. The efficiency of shields which reflect partly diffusely and partly specularly is also discussed. A.

535.23.08 : 537.525 : 621.383.3

511. Sensitive ultraviolet meters. PAL, A. B. *Rev. Sci. Instrum.*, **19**, 529–32 (*Aug.*, 1948).—A glow tube with Th electrodes can be used to measure the intensity of ultraviolet light. The simple circuit used for this purpose does not give reliable results for photo-currents below 10^{-10} A, and the exposure time to light may become several hrs. The writer has devised certain improved methods which can measure small photo-currents of the order of 10^{-13} A, requiring an exposure time of only a few min. If the exposure time is increased to several hrs, then it is possible to measure currents even below 10^{-14} A, provided the components are carefully insulated. A.

535.23.08 : 539.16.08

512. A universal radiation-meter; description, principle and range of applications. REITER, R. *Z. Instrum-Kde*, **64**, 105–21 (*April–June*, 1944) *In German.*—

The instrument uses Geiger counters in a special connection and a linear direct-reading galvo as registering instrument. It is thus suitable for counting single impulses as well as for measuring very low up to highest radiation intensities, and is instant-reading. It lends itself to being used with recording instruments, mirror galvos or oscillographs. Further possible uses are as an instant-reading stray radiation meter or a measuring instrument for corpuscular radiations. The accuracy of the device is documented by experimental data. V. W. R.

535.24.001

513. Remarks on the validity of the axioms of additivity and of transitivity in visual heterochromatic photometry. KŒNIG, H. *Rev. Opt.* (*Théor. Instrum.*) **27,** 551–4 (*Aug.–Sept.*, 1948) *In French.*—The axiom of additivity is that $a + c = b + d$ if $a = b$ and $c = d$; that of transferability is that $b = c$ if $a = b$ and $a = c$. These axioms are assumed to be true in heterochromatic photometry, where a, b, c and d refer to lights of different colours. The results of a large number of direct observations show that the axioms may be untrue to the extent of 2% for light from a W lamp after passage through coloured filters, while the error may reach 5% for light at the ends of the visible spectrum. The methods having been used for examining the validity of these axioms are discussed and criticized. J. W. T. W.

535.241.33 : 621.326.4

514. Variations in the electrical resistance and the light output of the tungsten filament in some vacuum standard lamps. TERRIEN, J. *Rev. Opt.* (*Théor. Instrum.*) **27,** 351–2 (*June*, 1948) *In French.*—See Abstr. 476 B (1949).

535.243 : 535.247.4

515. New recording microphotometer with direct intensity indication. LAFFINEUR, M. *C.R. Acad. Sci., Paris,* **227,** 900–2 (*Nov.* 3, 1948) *In French.*—Describes a recording microphotometer in which two beams of light from the same lamp pass respectively through the spectrograph and a density wedge and then alternate on a photocell. The out-of-balance photocurrent is amplified and actuates a motor which moves the wedge until a balance is obtained. J. W. T. W.

535.243 : 535.514.2

516. Talbot's law and Malus' law in photoelectric spectrophotometry. STEINBERG, J.-L. AND VODAR, B. *Rev. Opt.* (*Théor. Instrum.*) **27,** 611–34 (*Oct.*, 1948) *In French.*—An examination of the extent to which Talbot's law is obeyed by a Na hydride argon-filled photocell. The sector discs used included one of novel design, and the illumination of the cell was varied by means of a grille as well as by the sector. The departures from Talbot's law were found to be generally small. In the case of Malus' law of polarization, agreement with theory was satisfactory up to an angle $\sim 70°$, but departures then became progressively greater. J. W. T. W.

535.243.3 : 537.312.5

517. Ultra-violet radiation measurement. III. Applications. SEITZ, E. O. AND MEYER, A. E. H. *Arch. tech. Messen, Issue* 153 (*Ref. J* 323–3) *T* 44–5 (*Feb.*, 1948) *In German.*—The spectral sensitivity of photocells is found by comparison with a thermo-element. Methods of finding relative and absolute spectral energy distribution by monochromator and photocell are given. A quicker way is to measure the radiation through a filter of known characteristics directly by a photocell, and suitable types of filters for ultraviolet of wavelengths from 0·26–0·366 μ are detailed. Dosimeters measure radiant intensity × time ≡ energy but the biological effect is dependent on the relative value of the 2 factors, and dosimeters are used only to check the radiant intensity. Filters are used to eliminate fluorescence when measuring translucence of fluorescing substances. Reflectivity measurements on MgO, Al, Rh, Ag and Ni are given. A table showing corresponding light and u.v. radiation units is included. V. W. R.

535.245.22

518. Two methods of determining the illumination due to large area sources of light. YUROV, S. G. *J. Tech. Phys., USSR,* **18,** 1073–87 (*Aug.*, 1948) *In Russian.*—It is shown that no simple method of det. the illumination due to large area radiators has yet been given, although there is a definite need for it in illumination and thermal engineering. Author describes a simple type of integrator for determining the total intensity due to large area sources of any shape and angle of slope, as well as a grapho-analytical method of determination not requiring any special means such as nomograms, networks, etc. The latter method, too, is unrestricted in its application to sources of any shape and angular position. A.

535.247.1 : 771.53

519. Cause and correction of local errors in photographic photometry. DE VAUCOULEURS, G. *Rev. Opt.* (*Théor. Instrum.*) **27,** 541–6 (*Aug.–Sept.*, 1948) *In French.*—The cause of uneven sensitivity over the surface of a photographic plate is not inequalities in emulsion thickness due to lack of planeness of the glass. The nature of the unevenness is investigated and a method by which a correction can be applied to the measured densities, so as to reduce considerably the errors arising from unevenness, is described. J. W. T. W.

535.247.4

520. Physical methods in practical use for heterochromatic photometry at the Swiss Bureau of Weights and Measures. KŒNIG, H. *Rev. Opt.* (*Théor. Instrum.*) **27,** 547–50 (*Aug.–Sept.*, 1948) *In French.*—Describes the physical photometers which consist (*a*) of a thermopile which, used in turn with 8 colour filters, gives a close approximation to the standard luminosity curve; (*b*) three different types of rectifier photocells, each with correction filters. Conversion factors for these cells are obtained for a number of different sources of light by means of the fundamental photometer (*a*). The cells are tested for linearity and the non-selectivity of the surface of the integrating sphere used is tested by making measurements in six regions of the spectrum. J. W. T. W.

535.317 : 535.81

521. General theory of isoplanatism for apertures and generic fields. I. DI JORIO, M. *Nuovo Cim.,* **5,** 447–74 (*Oct.*, 1948) *In Italian.*—A generalized definition of isoplanatism is given and applied to centred systems, which yields the difference of optical length between the fundamental waves. The theory is

given for meridian pencils based on the general differential law for 2 independent waves. As the field angle may take any finite value, the theory extends the scope of optical calculations. After suitable transformations the equation contains only the intrinsic variables characterizing the pencils considered and the total aberration of aperture, the necessary and sufficient condition of tangential isoplanatism then taking a simple and invariant form. The theory is then shown to be valid for systems more general than the centred ones, viz. those with a single plane of symmetry in which the linear isoplanatic element may have any direction. This makes it important for photographic wide angle objectives, to which the equations derived are immediately applicable. Some further aspects of the problem and characteristic relations are shown, in particular, the validity of some Gaussian laws and of Herschel's and Lihotzky–Staeble's conditions for general values of the field is investigated. It is seen that the principal ray is more important even than that of the optical axis in the consideration of centred systems. The main rules of the theory, especially the general differential law for 2 independent rays, are further clarified in an appendix. A.

535.318 : 771.35

522. The best geometrical axial focus of photographic objectives. TORALDO DI FRANCIA, G. AND CALCAGNILE, C. *Atti Fond. Giorgi Ronchi*, **3**, 10–17 (*Feb.–April*, 1948) *In Italian.*—Computation of a table for the instantaneous determination of the optimum position of the axial geometrical focus and the radius of the corresponding circle of confusion, as a function of the ratio of marginal to zonal spherical aberration, and of the aperture of the objective. A.

535.329–2/.31 : 535.39

523. Anomalous dispersion of very thin layers of potassium. HACMAN, D. *Bull. Soc. Roumaine Phys.*, **41** (*No.* 76) 69–72 (1940) *In German.*—In layers four atoms thick (2 mμ) K shows anomalous dispersion at 3 800 Å, the frequency of a selective photoelectric effect, whereas layers 20 mμ thick show normal dispersion from 2 500–5 500 Å. Curves of the refractive index (n) and the absorption coefficient (k) against λ are given. $2nk\lambda$ has a maximum at 3 800 Å for the thin layers which shifts to 4 300 Å for the 20 mμ layers. D. H. W.

535.33 : 539.153

Atomic energy levels. *See Abstr.* 665

535.33.03 : 537.542

Discharge tube producing the atomic spectrum of hydrogen. *See Abstr.* 611

535.33.03 : 621.316.72.014.31

524. Magnetic stabilizer for direct current arcs in spectroscopy. CAVE, G. C. B. *Analyt. Chem.*, **20**, 817–21 (*Sept.*, 1948).—Abstr. 104 B (1949).

535.33.03 : 621.385.1 : 621.318.572

525. An intensity regulator for a hydrogen discharge tube. PONDROM, W. L. AND ROBERTSON, W. W. *Rev. Sci. Instrum.*, **19**, 561–4 (*Sept.*, 1948).—Abstr. 471 B (1949).

535.33.072 : 538.56 : 621.317.36

526. A grating spectrometer for millimeter waves. COATES, R. J. *Rev. Sci. Instrum.*, **19**, 586–90 (*Sept.*, 1948).—A spectrometer based upon a reflecti echelette type grating was designed for the 3–12·5 m range. The operation of the spectrometer is co pletely automatic, and the curve of received sign intensity v. grating angle for all orders (including zer is registered by a recording output meter. From t record, the grating angles corresponding to t intensity peaks at the different orders can be re within $\pm 1'$ of arc, giving an accuracy of abo $\pm 0{\cdot}04\%$ for measurements of the wavelengths mm monochromatic sources. The factors th influenced the design of the components of the spectr meter are presented. The illumination of the grati by the aerial system is incorporated in the derivatic of the theoretical equation for the grating intensi curve. It is shown that this theoretical curve agre closely with the actual spectrometer records.

535.338.332 : 535.3

527. Theory of the fine structure of the H_α lin CALDIROLA, P. *Nuovo Cim.*, **5**, 399–415 (*Oct.*, 194 *In Italian.*—The distribution of intensity observed f the H_α-line in emission and absorption spectra discussed from a theoretical point of view. calculating the intensity of the several components H_α, the following effects are investigated: (*a*) t $2S_{1/2}$ energy level displacement recently observed b Lamb and Retherford; (*b*) the different excitatic probabilities, by means of electron collisions, for t various levels $n = 3$ from which electrons jump durin the process of H_α emission; (*c*) perturbing effect o the $2S_{1/2}$ and $2P_{1/2}$ states of the electric field in th discharge tube; (*d*) metastability of $2S_{1/2}$ level. Usir the results obtained the graph of intensity v. frequenc was calculated for the H_α-line. A shape of the typ $I(\nu) = I_0\varepsilon^{-k(\upsilon-\upsilon_0)^2}$, where the value of the parameter is empirically assumed, is attributed to every lin The agreement between theoretical and experiment curves is surprisingly good: the theoretical graph intensity v. frequency coincides, within the limits experimental error, with the graph obtained by takin the average of a set of microphotometer measur ments [Abstr. 1815, 2492 (1947)]. The theoretic results concerning the intensity of H_α in absorptio spectrum at least do not contradict the inconclusiv experimental data.

535.338.332/.33

528. The hyperfine structure of the W I spectrum KOPFERMANN, H. AND MEYER, D. *Z. Phys.*, **12** (*Nos* 7–12) 685–90 (1948) *In German.*—19 lines we analysed by means of a Fabry–Pérot interferomete The spin of W^{183} is $\frac{1}{2}$. The displacement between th $5d^4\,6s^2\,{}^5$D-terms of W^{183} and W^{184} is $\Delta\nu = 0{\cdot}073\ \mathrm{cm}^{-1}$; between the same terms of W^{184} an W^{186}, $\Delta\nu = 0{\cdot}066$. L.

535.338.4 : 551.510.41 : 551.593

Spectroscopic evidence of methane in the earth atmosphere. *See Abstr.* 792

535.338.4 : 551.593

The spectrum of the night sky. I. Measures of wav lengths and identifications. *See Abstr.* 790

535.343–14 : 539.133 : 539.15

529. Microwave spectra of some linear *XYZ* mol cules. TOWNES, C. H., HOLDEN, A. N. AND MERRIT F. R. *Phys. Rev.*, **74**, 1113–33 (*Nov.* 1, 1948).— Measurements of the pure rotational spectra of

number of isotopes and vibrational states of OCS, ClCN, BrCN and ICN near 1 cm wavelength have been made. Experimental techniques used and interpretation of the spectra of linear *XYZ* molecules are discussed. Tables include frequencies and intensities of lines and comparison with theoretical values, rotational constants B_0, rotation-vibration constants α, *l*-type doubling constants, internuclear distances, half-width parameters of lines, quadrupole coupling constants and nuclear quadrupole moments. Agreement between experimental results and available theory is good in all cases except for the values of *l*-type doubling constants. A.

535.343.1–15 : 539.13 : 541.651

530. Infra-red absorption spectrum and structure of trioxane. RAMSAY, D. A. *Trans. Faraday Soc.*, **44**, 289–95 (*May*, 1948).—The spectrum of trioxane between 3 500 and 700 cm^{-1} was determined under moderate resolving power using a double-beam spectrometer. The number of frequencies observed in the vapour spectrum has been compared with the numbers of frequencies permitted by the selection rules for the various possible configurations of the trioxane ring and shown to provide strong evidence for a "chair" structure for this molecule. This conclusion is in agreement with the X-ray and dipole moment evidence. Assignments for the ring vibrations of trioxane have been made and compared with the corresponding assignments for cyclohexane, tetrahydropyran and dioxane. A.

535.343.2

531. Absorption and fluorescence spectra of the methyl-naphthalines. GAVĂT, I., IRIMESCU, I., ȚIȚEICA, R. AND VENCOV, ST. *Bull. Soc. Roumaine Phys.*, **42** (*No.* 78) 63–71 (1941) *In French.*

535.343.2

532. The absorption spectrum of naphthalene between 0·8 and 1·5 μ. GĂLĂȚEANU, B. *Bull. Soc. Roumaine Phys.*, **43** (*No.* 79) 5–8 (1942) *In German.*

535.343.2

533. The absorption spectrum of S_2 in the Schumann region. MAEDER, R. *Helv. Phys. Acta*, **21** (*No.* 5) 411–28 (1948) *In German.*—Vibrational analyses of two band-systems have been made, which lead to the following values (cm^{-1}):—

ν_e	ω_e	$x_e\omega_e$
58 976·8	794	4·00
707·2		
576·8		
55 598·2	830·2	3·75

Some band-heads assigned to $S^{32}S^{34}$ have been observed. R. F. B.

535.343.2 : 539.132 : 548.7

534. Theory of the absorption spectra of molecular crystals. DAVYDOV, A. S. *J. Exp. Theor. Phys., USSR*, **18**, 210–18 (*Feb.*, 1948) *In Russian.*—A general theory of the energy states of the electrons in molecular crystals. The theory is applied to elucidating some peculiarities of the absorption spectra of monoclinic crystals of the naphthalene and anthracene type. It is shown that in this type of crystals the non-degenerated energy levels are displaced and split up into two differently polarized components. A.

535.343.32

535. Near infra-red absorption spectrum of benzyl alcohol diluted in carbon tetrachloride. CICCONE, A. *Nuovo Cim.*, **5**, 489–92 (*Oct.*, 1948) *In Italian.*—The diagram shows three sharp absorption peaks deriving from the group OH and corresponding to those observed by Berti in ethyl alcohol and in phenol. A.

535.343.32–15 : 539.163

536. Absorption spectrum of hexavalent plutonium. BETTS, R. H. AND HARVEY, B. G. Letter in *J. Chem. Phys.*, **16**, 1089–90 (*Nov.*, 1948).—PuO_2^{++} in HNO_3 solution has an intense narrow band at 8 330 Å due to a transition in the 5*f* shell, but the spectrum is otherwise similar to that of UO_2^{++}. There is some vibrational structure indicating a symmetrical frequency of 657 cm^{-1}. D. H. W.

535.343.4–14 : 535.338.334

537. Pressure broadening in ammonia at centimeter wave-lengths. SMITH, D. F. Letter in *Phys. Rev.*, **74**, 506–7 (*Aug.* 15, 1948).—The absorption coefficients, α, for NH_3 at 3·20 and 4·43 cm have been measured up to 7 atmos. pressure. The results are best expressed by $\alpha = \alpha_i e^{-ap} + \alpha_s(1 - e^{-ap})$ where α_i contains the impact shape factor of Van Vleck and Weisskopf while α_s contains a statistical, triangular shape factor with zero for the resonant (Bohr) frequency. *ap* is the ratio of the volume of the collision sphere to the volume/molecule. D. H. W.

535.343.4–14 : 537.228.5

538. Microwave absorption line frequencies of methyl alcohol and their Stark effect. COLES, D. K. Letter in *Phys. Rev.*, **74**, 1194–5 (*Nov.* 1, 1948).—Lines of CH_3OH for $J = 2$ to 10, $\Delta J = 0 = \Delta M$, are identified and their exact frequencies ($\sim$ 25 000 Mc/s) and 1st-order Stark coefficients are given. The interpretation indicates a dipole moment of 0·895 *D* along the axis and 1·41 *D* perpendicular. D. H. W.

535.343.4–31

539. Absorption spectra in the ultra-violet of the derivatives of aniline. I. Para-toluidine; para-chloraniline. ȚINTEA, H. *Bull. Soc. Roumaine Phys.*, **43** (*No.* 79) 9–13 (1942) *In French.*

535.343.4–31

540. Absorption spectrum of aniline in the near ultra-violet. ȚIȚEICA, R. *Bull. Soc. Roumaine Phys.*, **43** (*No.* 79) 15–34 (1942) *In French.*

535.37

541. Decay and quenching of fluorescence in willemite. KRÖGER, F. A. AND HOOGENSTRAATEN, W. *Physica, 's Grav.*, **14**, 425–41 (*Sept.*, 1948) *In English.*—With the aid of measurements of the efficiency and the decay of the fluorescence of willemite, it is shown that fluorescence excited by short-wave u.v. radiation is quenched by 2 kinds of radiation-less processes One starts from the high excited state reached in the excitation process; its rate is governed by a 1st order process which, competing with the 2nd order process leading to fluorescence, causes the efficiency of fluorescence to be dependent on the exciting intensity. This process is increased by Fe and also by ball-milling. The second radiation-less process starts from an excited state of the Mn centre. It runs parallel to the slow fluorescence transition and thus influences

the decay of the fluorescence. It increases strongly with temperature; the variation can be satisfactorily described with the aid of an activation energy. For excitation by long-wave u.v. only the latter process plays a part. A.

535.37 : 541.123.5

542. The incorporation of uranium in calcium fluoride. KRÖGER, F. A. Letter in *Physica, 's Grav.*, **14,** 488 (*Sept.*, 1948) *In English.*—U can be incorporated in CaF_2 when the excess of charge of $U(6^+)$ over $Ca(2^+)$ is compensated by replacing 4 F-ions by 4 O-ions: $(CaF_4)^{2-} \rightarrow (UO_4)^{2-}$; i.e. as a solid solution of Ca_2F_4 with $(CaU)O_4$. The centre of fluorescence in this system is the U-ion surrounded by 4 O- and 4 F-ions. C. B. A.

535.37 : 548.0

543. Determination of probabilities for radiative and non-radiative processes in crystals. HELLWEGE, K. H. *Naturwiss.* **34** (*No.* 7) 212 (1947) *In German.*—Suggests relations between the probability constants, decay constants and luminosity due to transitions from a given term which should enable these constants to be determined experimentally. Such experiments are being carried out on $Eu_2(SO_4)_3 8H_2O$. J. E.

535.375.5

544. Raman spectra of some di-substituted benzene derivatives. ȚINTEA, H. *Bull. Soc. Roumaine Phys.*, **43** (*No.* 80) 43–7 (1942) *In French.*

535.375.5 : 545.822

545. Symposium on Raman spectra. *Acta Phys. Austriaca,* **1** (*No.* 4) 287–397 (1948) *In German.*—Contents: Introduction by Kohlrausch; Kohlrausch and Wittek, H., "Nitroamine, nitramine, nitrourethane"; Wittek, H., "Polynitroparaffins"; Kahovec, L., "Condensation products of aldehydes with amines II"; Vogel-Högler, R., "Organic sulphur-compounds I, II: Alkyl sulphides—mustard oils—thiocyanates; The sulphonyl and sulphuryl groups"; Euckon, M. and Wagner, J., "Sulphur compounds III: polythionates"; Seewann-Albert, H., "Chloral, cromal, and their hydrates"; Seewann-Albert, H., and Kahovec, L., "Acid halides I: Halides of the acetic, propionic and toluic acid"; Seewann-Albert, H., "Acid halides II"; Gerhold, M. and Kahovec, L., "Raman investigations of crystal alcoholates I"; Rossler, F. C., "Internal mobility of the cyclohexane trough model"; Kohlrausch, K. W. F. and Schreiner, H., "Raman-spectroscopy of D, Cl and Br compounds of thiophene"; Theimer, O., "The question of the degree of dissociation of dissolved nitrates considered on Raman spectroscopy."

535.375.5 : 548.0

546. Raman effect in cubic crystals. COUTURE, L. AND MATHIEU, J. P. *Ann. Phys., Paris* (*Sér.* 12) **3,** 521–49 (*Sept.–Oct.*, 1948) *In French.*—It is shown that the intensity and the depolarizing factor of the Raman lines of a crystal belonging to any group of the cubic system varies with the orientation, with respect to the directions of the incident light and observation, of the axes of symmetry of the crystal. These variations are predictable on the classical theory of the Raman effect. Verification of the predictions have been obtained experimentally for the spectra of these crystals: F_2, $[SnCl_6]K_2$, $[Zn(CN)_4]K_2$, $(NO_3)_2Sr$, $(NO_3)_2Ba$, $(NO_3)_2Pb$, $NaClO_3$, $NaBrO_3$, $[Mg(OH_2)_6](BrO_3)_2$, $[Zn(OH_2)_6](BrO_3)_2$, NH_4Cl. It is possible to observe all the Raman lines of a cubic crystal in a single, suitably chosen, orientation. The second part of the paper is devoted to a detailed investigation of the spectra obtained. A.

535.375.5 : 548.

547. The vibrational spectra of molecules and complex ions in crystals. I. General theory. HORNIG, D. F. *J. Chem. Phys.*, **16,** 1063–76 (*Nov.*, 1948).—In a crystal is approximated as a harmonic oscillator only a very small number of vibrational modes may be active in the infrared or Raman spectra. These modes are all totally symmetric with respect to translation. They must also have proper symmetry with respect to the factor group of the space group which we have called the unit cell group. The active frequencies may be calculated from a single unit cell. Further, the number and symmetry type of vibrational modes may be correctly calculated from the local symmetry (site group) of the centre of gravity of each kind of molecule. In the harmonic approximation the spectrum should consist of very sharp lines. The wide bands obtained experimentally are probably due to combination lines with lattice vibrations and indicate anharmonic coupling between molecular and lattice modes. Such combinations may cause apparent violations of selection rules for internal vibrations. The symmetry basis for obtaining selection rules in this case is given. The importance of obtaining spectra over a wide temperature range and particularly at very low temperatures is emphasized. In cases where all internal modes have a frequency $\geqslant$ frequency of lattice modes the problem is examined from the point of view of the Born–Oppenheimer approximation. It is shown that for some symmetries perturbations linear in the lattice displacement may occur. In these cases considerable splitting of degenerate molecular vibration modes is possible. Groups for which 1st-order splitting is not expected are listed. Symmetry species of other groups are classified into those which may and which may not be split in this approximation, and the lattice modes responsible for splitting are classified as rotations or translations and by symmetry type. A.

535.41 : 535.342

548. Use of Lippmann plates as filters. DELCROIX, J.-L. *Rev. Opt.* (*Théor. Instrum.*) **27,** 493–509 (*Aug.–Sept.*, 1948) *In French.*—Lippmann plates prepared with the green mercury line become absorbing filters with a very narrow band when developed and fixed. The characteristics of the band, and the effects of temperature and humidity on it, are studied, and a partially satisfactory theory is developed. C. B. A.

535.415 : 531.787

Dynamic pressure measurement by optical interference. *See Abstr.* 467

535.42 : 534.321.9

549. Some optical effects of ultrasonic waves. SETTE, D. *Nuovo Cim.*, **5,** 493–7 (*Oct.*, 1948) *In Italian.*—The diffraction patterns produced by the Lucas–Biquard effect cannot be symmetrical if the waves sent by an ultrasonic source are not quite plane as in the experimental conditions. This lack of symmetry becomes strikingly apparent when testing

the liquid at large distances from the source. The author finds that the observed phenomena agree very well with the results to be expected from the theory of ultrasonic gratings. A.

535.43 : 538.56

550. Contributions to the theory of diffraction of electromagnetic waves by spherical particles. LJUNGGREN, T. *Ark. Mat. Astr. Fys.*, **36 A**, *Paper* 14, 36 *pp.* (1948) *In English.*—The exact solution of this problem has been given previously [Mie, 1908; Debye, 1909]. The present paper outlines a new method of studying the numerical properties of the solution. Some results of other workers are confirmed, but the intensity factor given by Bremmer and v. d. Pol in the expression for the rainbow is shown to be erroneous. Further results will be given in a later paper. P. M. D.

535.514.3

551. Improved Glan-Foucault prism. ARCHARD, J. F. AND TAYLOR, A. M. *J. Sci. Instrum. Phys. Ind.*, **25**, 407–9 (*Dec.*, 1948).—The modified prism described has advantages over the normal type due to the reduction of multiple reflections in the air film. The prism is quite economical in the use of calcite when cut from the original rhomb. A.

535.55 : 548.0

552. Photo-elastic effect in barium nitrate. BHAGAVANTAM, S. AND SURYANARAYANA, D. *Nature, Lond.*, **162**, 740 (*Nov.* 6, 1948).—Values of the differences between the stress-optical constants are given for single crystals showing that the birefringence caused by pressure along a cube axis is the largest recorded for any cubic crystal. The difference between $(q_{11} - q_{12})$ and $(q_{11} - q_{13})$ is about 27%. See Abstr. 109 (1948). H. G. J.

535.83 : 531.719.24

553. A range-finder testing laboratory. GARDNER, I. C. *J. Appl. Phys.*, **19**, 721–8 (*Aug.*, 1948).—A laboratory for testing optical range finders is described. The central piece of the equipment is a testing instrument that optically simulates targets at ranges from 855 yd to infinity, introducing the corresponding angular parallax between two beams of light at a separation of 15 ft, with angular errors not exceeding 1″. This instrument is installed in a room with temperature control equipment and also provision for applying directed radiation to simulate extremes of temperature substantially as great as those encountered under service conditions. Such a laboratory provides convenient means of rapidly acquiring exact information regarding the behaviour of a range finder and localization of the sources of error. A.

535.83 : 531.719.24

554. The testing of range finders. GARDNER, I. C. *J. Appl. Phys.*, **19**, 729–38 (*Aug.*, 1948).—The errors of a range or height finder are divided, on the basis of origin, into 4 groups, namely: (1) External errors from lack of homogeneity in the air column between the instrument and target. (2) Instrumental errors from defective performance of the instrument. (3) Physiological errors caused by physiological limits upon the performance of the observer's eye. (4) Psychological errors that have their origin in the psychological limitations of the ability of the observer to judge the range setting correctly. The designer can exert direct control, within limits, upon the instrumental errors. The 3 other classes cannot be controlled directly, but, given a qualitative and quantitative knowledge of their characteristics, it is possible to design a range finder or height finder in such manner as to lessen their detrimental effects. A brief discussion is given of the different known sources of error in each of the four classes, with typical values of the resulting errors as obtained by measurements made in the range-finder testing laboratory established at the U.S. National Bureau of Standards. A.

HEAT 536

536.421

555. Volume change of hexamethyl benzene. CHIHARA, H. AND SEKI, S. Letter in *Nature, Lond.*, **162**, 773–4 (*Nov.* 13, 1948).—The volume increases discontinuously by about 2% at 110°C, and passes through a maximum (178·5 cm³/mole) at 130°, reaching a minimum (160·5 cm³/mole) just before melting at 165·5° with a volume increase of 30 cm³/mole. A. J. C. W.

536.422.15.08

556. The vapor pressures of some alkali halides. COGIN, G. E. AND KIMBALL, G. E. *J. Chem. Phys.*, **16**, 1035–48 (*Nov.*, 1948).—The vapour pressures of six alkali halides, NaBr, NaI, KI, CsCl, CsBr and CsI, have been measured in the range from about 10^{-4} mm to 0·1 mm pressure. The measurements were made by the diffusion method, using an O-coated W filament as detector. A.

536.422.5

557. Production of ice crystals by the adiabatic expansion of gas. VONNEGUT, B. Letter in *J. Appl. Phys.*, **19**, 959 (*Oct.*, 1948).

536.453

558. A solar furnace for the production of very high temperatures. TROMBE, F., FOËX, M. AND LA BLANCHETAIS, C. H. *C.R. Acad. Sci., Paris*, **223**, 317–19 (*Aug.* 12, 1946) *In French.*—A parabolic mirror, 2m in diameter and 0·85 m focal length, was used to concentrate solar radiation. Temperatures up to 3 500°K may be obtained near the focus. The following substances were melted and the melting points were determined: ThO_2, MgO, ZrO_2, CeO_2, CaO, GlO, Cr_2O_3, La_2O_3, Al_2O_3 and TiO_2. L. S. G.

536.48

559. A transfer tube for the Collins helium cryostat. DESIRANT, M. C. AND HORVATH, W. J. Note in *Rev. Sci. Instrum.*, **19**, 718–19 (*Oct.*, 1948).

536.483

560. Production of temperatures lower than 1°K by pumping off vapours above liquid helium. ESSELSON, B. N. *J. Exp. Theor. Phys., USSR*, **18**, 795–7 (*Sept.*, 1948) *In Russian.*—An apparatus is described for the production of temperatures lower than 1°K, in which the perforated membrane is substituted by a bent capillary. This apparatus permits lower temperatures to be reached than is possible by the membrane type of equipment. The diameter of the

membrane and capillary opening are equal. The principle is stated that along the capillary there is a temperature difference forcing the layer of He II to move from the point of higher to that of lower temperature. This results in a slowing down of the evaporation produced by the He II layer and consequent lowering of the temperature. A.

536.531 : 621.316.8 : 621.317.39

561. The use of thermistors for the automatic recording of small temperature differences. HERINGTON, E. F. G. AND HANDLEY, R. *J. Sci. Instrum. Phys. Ind.*, **25**, 434–7 (*Dec.*, 1948).—Some practical details of manipulation are presented. An automatic apparatus for recording the freezing-point and another for measuring the boiling-point of a liquid are described in which thermistors are employed as the temperature-sensitive elements. Reproductions of some tracings of records so obtained are given. The apparatus discussed may be used for the estimation of chemical purity, for the determination of molecular weights, or for recording small pressure fluctuations in a system. A.

536.582.1 : 536.483

562. Gas thermometer for automatic control of low temperatures. TUNNICLIFF, D. D. *Analyt. Chem.*, **20**, 962–4 (*Oct.*, 1948).—A gas thermometer is described for the automatic control of temperatures down to −180°C as required in the separation of gases by isothermal distillation. The He-filled reservoir of the thermometer is located in a Cu block which surrounds the distilling tube. A constant heat loss from the Cu block and the distilling tube to liquid air is offset by intermittent heating which is controlled through a relay by the position of the Hg meniscus in the manometer. The thermometer can be preset to control the temperature at any desired point by proper adjustment of the volume of Hg in the manometer. The temperature is controlled to approximately ±0·3°C. The apparatus is simple to construct and is easy to operate. A.

536.587 : 536.48 : 621.316.74

563. An automatic temperature control for a liquid helium cryostat. ANDREW, E. R. *J. Sci. Instrum. Phys. Ind.*, **25**, 416–17 (*Dec.*, 1948).

536.62 : 537.312.62

564. Calorimetric measurements on normal and superconductive tantalum. DÉSIRANT, M. *Rep. Internat. Conf. "Low Temperatures"* (1946) (*Phys. Soc., Lond.*) *II*, 124–7 (1948) *In English.*—In sufficiently pure Ta the electrical, magnetic and specific heat changes associated with the superconducting transition occur at the same temperature [Abstr. 1616 (1946)]. D. S.

THERMODYNAMICS 536.7/.8

536.752 : 539.133 : 541.113

565. Heat capacity of methanol vapour. ROWLINSON, J. S. Letter in *Nature, Lond.*, **162**, 820–1 (*Nov.* 20, 1948).—Supersonic velocity measurements favour a value of about 1 300 cal. for the height of the barrier restricting internal rotation. This indicates that the discrepancy between the spectroscopic and calorimetric entropies of 1·0 ± 0·25 E.U. [Crawford: *J. Chem. Phys.*, **8**, 744 (1940)] is real: it may arise from random orientation of H-bonds in the crystal. R. F. B.

ELECTRICITY 537

ELECTROSTATICS . DIELECTRICS 537.2

537.22 : 537.24

566. Mechanism of the electrification of solids and liquids by atomization. FRENKEL, Y. I. *J. Exp. Theor. Phys., USSR*, **18**, 799–806 (*Sept.*, 1948) *In Russian.*—The electrification of solid bodies (ionic dielectrics) by atomization may be explained by the selective effect in the formation of ionic holes of one of the two possible signs (whose formation requires less energy) on the surface of the crystal. Simultaneously the holes of the opposite sign form a space (diffuse) layer of electrification. The potential jump in this double layer balances the energy difference of hole formation of the ions of different signs. When a substance is atomized, the particles take a charge of the same sign as the original surface. With an increase of the dimensions of the particles their specific charge is correspondingly reduced, and under the influence of a supporting air current a separation of the lighter particles from the heavier ones takes place, which is also a separation of particles of unequal charge. Thereby strong electric fields of the order of 1 000 V/cm are set up. The electroballistic effect, i.e. the charging up of water droplets by spraying, may be explained analogously. A.

537.226 : 621.3.015.5 : 621.315.6

567. Statistical method of determination of the breakdown stress of a dielectric. SINGERMAN, A. S. *J. Tech. Phys., USSR*, **18**, 1029–43 (*Aug.*, 1948) *In Russian.*—Abstr. 364 B (1949).

537.226 : 621.3.015.5 : 621.315.616

568. A note on crystallite size and intrinsic electric strength on polythene. BIRD, D. W. AND PELZER, H. *Proc. Instn Elect. Engrs, Pt I*, **96**, 44–5 (*Jan.*, 1949).—See Abstr. 371 B (1949).

537.226.082 : 621.315.612 : 666.1 : 621.317.333.82

569. The measurement of the intrinsic electric strength of glass. KELLER, K. J. *Physica, 's Grav.*, **14**, 475–87 (*Sept.*, 1948) *In English.*—Abstr. 414 B (1949).

537.228.2 : 548.0

570. Electrostrictive effect in barium titanate ceramics. MASON, W. P. *Phys. Rev.*, **74**, 1134–47 (*Nov.* 1, 1948).—When a direct current bias is applied to a multicrystalline barium titanate ceramic, an alternating voltage can excite resonances in the ceramic. Four modes of motion have been excited—a longitudinal mode at right angles to the applied field, a radial mode of a circular plate at right angles to the applied field, a thickness longitudinal mode, and a thickness shear mode. The first three are excited when the a.c. field is applied in the same direction as the d.c. polarization, but the fourth is excited when the a.c. field is at right angles to the

d.c. polarization. The amount of motion is larger than in magnetostrictive materials, and it appears that Ba titanate may be an important electromechanical transducing element. All of these modes can be accounted for on the basis of a second-order electrostrictive effect. Two electrostrictive constants are involved and these have been evaluated as $Q_{12} = -2{\cdot}15\times10^{-12}$ cm⁴/(statcoulombs); $Q_{11} = +6{\cdot}9\times10^{-12}$ cm⁴/(statcoulombs). Using these constants, the measured electromechanical coupling factors for the four modes are evaluated, and these compare well with the calculated values. A theoretical explanation of this effect is given which depends on the fact that when a given domain becomes ferroelectric it loses its cubic structure and becomes tetragonal. In this process it expands 1% along the tetragonal axis and contracts ½% along the other two axes. In the ceramic piece all directions for the tetragonal axis are equally probable, but an applied field can cause the domains in the direction of the field to grow at the expense of domains perpendicular to the field. The measured ratio of 3 to 1, compared to the 2 to 1 ratio observed by X-rays for a single crystal, is accounted for by the nature of the ceramic material which does not join up for all grains. This does not prevent the ceramic from increasing in thickness but does cut down the radial contraction. Experimental measurements of the electrostrictive effect are given, and it is shown that the displacement is ∝ the square or products of the electric displacements in the ceramic. A.

ELECTRIC CONDUCTION . CURRENTS 537.3

537.311.5 : 537.312.62

571. Some measurements of the electrical resistance of thin metallic films. VAN ITTERBEEK, A. *Rep. Internat. Conf.* "*Low Temperatures*" (1946) (*Phys. Soc., Lond.*) *II*, 118–24 (1948).—A brief summary of previously published work [Abstr. 2603–5, 2609 (1946), 1523 (1947)]. D. S.

537.312.5 : 539.164.9 : 621.383.42

572. Towards understanding of the selenium photoelement. V. Action of α-rays. BECKER, A. *Z. Phys.*, **118** (*Nos* 11–12) 695–705 (1942) *In German.*—To study the boundary layer structure in the conductor/semiconductor system of Se photocells these were subjected to α-ray irradiation. It produced no measurable e.m.f., but resulted in gradual destruction of the photocell action. Possible reasons were investigated. The optical properties were not found to be altered, nor were there changes in the Se structure. Electrical variations in the semi-conductor do not appear to be the cause, since photocell action is destroyed only by α-rays, while intensive γ-rays produce no effect. V. W. R.

537.312.6

573. Determination of the order-disorder transition point in $FeNi_3$. KÄLLBÄCK, O. *Ark. Mat. Astr. Fys.*, **34 B**, *Paper* 17, 6 *pp.* (1947) *In English.*—The electrical resistance of a rod $\sim 2\times0{\cdot}08\times0{\cdot}08$ cm was measured for rising and falling temperature over the range 350°–600°C. The order-disorder transition takes place at 506°, and is probably discontinuous. The Curie point is 586°. A. J. C. W.

537.312.62

574. Size effects in superconductivity. SHOENBERG, D. *Rep. Internat. Conf.* "*Low Temperatures*" (1946) (*Phys. Soc., Lond.*) *II*, 93–101 (1948).—Preliminary account of work since published in detail [Abstr. 2471–2 (1948)]. D. S.

537.312.62

575. Resistance in the intermediate state. ANDREW, E. R. *Rep. Internat. Conf.* "*Low Temperatures*" (1946) (*Phys. Soc., Lond.*) *II*, 101–4 (1948).—Preliminary account of work since published in detail [Abstr. 2473–4 (1948)]. D. S.

537.312.62

576. The high-frequency resistance of superconducting tin. LONDON, H. *Rep. Internat. Conf.* "*Low Temperatures*" (1946) (*Phys. Soc., Lond.*) *II*, 109–12 (1948).—A brief summary of previously published work [Abstr. 137 (1941)]. D. S.

537.312.62

577. Resistance of superconductors at microwave frequencies. PIPPARD, A. B. *Rep. Internat. Conf.* "*Low Temperatures*" (1946) (*Phys. Soc., Lond.*) *II*, 113–18 (1948).—Preliminary account of work since published in detail [Abstr. 3541–3 (1947)]. D. S.

537.312.62

578. Discussion on papers on superconductivity. MENDELSSOHN, K. *Rep. Internat. Conf.* "*Low Temperatures*" (1946) (*Phys. Soc., Lond.*) *II*, 127–8 (1948).—Oxford experiments confirm results by Boorse and others on the non-superconductivity of sodium-ammonium solutions. Some pre-war experiments were also mentioned in which a current was induced in a freely suspended superconducting sphere by a magnetic field; rotation of the inducing field twisted the sphere contrary to expectation. D. S.

537.312.62

579. Some peculiarities of the superconductivity of tantalum. LAZAREV, B. G. AND KHOTKEVICH, V. I. *J. Exp. Theor. Phys., USSR*, **18**, 807–11 (*Sept.*, 1948) *In Russian.*—Preliminary investigations into the superconductivity of Ta revealed the high sensitivity of the phenomenon to various lattice deformations. The anomalies of the super-conductivity of Ta were considered as representative of the group of "heavy" superconductors. A.

537.312.62 : 536.48.08 : 539.893.08

580. Measurements at low temperatures and high pressures. III. Superconductivity of indium and tin at bulk pressure of 1 370 and 1 730 kg/cm². KATZ, L. S., LAZAREV, B. G. AND SUDOVTSOV, A. I. *J. Exp. Theor. Phys., USSR*, **18**, 825–32 (*Sept.*, 1948) *In Russian.*—The influence of bulk compressions of 1 370 and 1 730 kg/cm² on the superconductivity of polycrystalline In and monocrystalline Sn was investigated in detail. At the said pressures the shift of the critical temperature T_h was 0·063 and 0·080, respectively, for In, and 0·080 and 0·097 for Sn. In this pressure range T_h and H_k are pressures. The shift of the critical magnetic field strength decreases with lower temperatures. The difference in shape (i.e. curvature) between the transition curve at normal and high

pressures for these metals is critically discussed and probable causes given. The measuring method was considerably improved. A.

537.312.62 : 536.63

581. On the thermal properties of superconductors. DAUNT, J. G. *Rep. Internat. Conf.* "*Low Temperatures*" (1946) (*Phys. Soc., Lond.*) *II*, 104–8 (1948).—A review of experiments on specific heat and Thomson heat of superconducting metals and time effects in the normal-superconducting transition. D. S.

537.312.62 : 538.56.029.4

582. Oscillographic investigation of the interruption of superconductivity by sound-frequency currents. GALKIN, A. A. AND LAZAREV, B. G. *J. Exp. Theor. Phys., USSR*, **18**, 833–6 (*Sept.*, 1948) *In Russian.*—Oscillograms of the interruption of the super-conductivity of Sn by a.c. currents of acoustic frequency (100–20 000 c/s) were obtained. From these oscillograms the upper limit of the time necessary for the transition from the normal into the superconducting state and vice versa was determined. The process was found to take less than 2×10^{-6} sec. The velocity of propagation of the boundary between the normal and the superconducting phase is more than 1 000 cm/sec. A.

537.363

583. The influence of direct electric current on the diffusion of substances precipitated in metals. BIANCHI, G. AND ZOJA, R. *Ric. Sci. Ricostruz.*, **17**, 1987–90 (*Dec.*, 1947) *In Italian.*—Tests were made on bars of four kinds of steel (two containing precipitated oxides). Direct currents, up to 900 A, at temperatures up to 450°c were passed through them for periods up to 480 hr. The bars were tested before and after each experiment for electrical resistance and elasticity or the microscopic structure was examined. No changes which could be attributed to ionic diffusion were observed. Control experiments were made with a.c. T. S. E. T.

537.363

584. A new compact Tiselius electrophoresis apparatus. MOORE, D. H. AND WHITE, J. U. *Rev. Sci. Instrum.*, **19**, 700–6 (*Oct.*, 1948).—An apparatus which incorporates the valuable features of the Tiselius method yet avoids its disadvantages of large size, costliness and difficulty of operation is described. It incorporates a 2 ml capacity Tiselius cell, and a highly precise optical system based on Longsworth's scanning modification of the Toepler schlieren method. Two schlieren lenses provide parallel light through the cell and reduce the optical path length. The overall dimensions of the self-contained unit are $63 \times 14 \times 12$ in. A.

537.363

585. Electrokinetic potentials of aged barium sulphate crystals. RUYSSEN, R. AND LOOS, R. Letter in *Nature, Lond.*, **162**, 741 (*Nov.* 6, 1948).—From measurements of streaming potential it is concluded that the equilibrium charge of pure $BaSO_4$ is negative in aq. KCl, saturated $BaSO_4$ and in 10^{-5} molar, aqueous-alcoholic KCl [cf. Ryerson *et al., J. Phys. Coll. Chem.*, **51**, 321 (1947)] provided these were the first solutions with which the crystals came in contact. If, however, the aq. solution is displaced by an aqueous-alcoholic one, the charge is reversed—probably because the $BaSO_4$ is precipitated out of the aqueous solution and then preferentially adsorbs Ba^{++} ions. S. J. G.

ELECTRIC DISCHARGES 537.52

537.523.74 : 536.52 : 535.235

586. Temperature measurements on a high-frequency torch discharge from the intensity distribution in N_2 and OH bands, and also by line-reversal. CRISTESCU, G. D. AND GRIGOROVICI, R. *Bull. Soc. Roumaine Phys.*, **42** (*No.* 78) 37–51 (1941) *In German.*—The temperature of the gas in the torch is deduced from the rotational intensity distribution of the N_2 band at 3 371 Å and the OH band at 3 064 Å. The results are compared with those by the sodium line reversal method. The temperature in the centre of the "flame" is between 3 500 and 4 000°K and is high enough to apply Saha's theory to the ionization. The ionization in the glow layer on the electrode may be attributed to fast electrons accelerated there by the strong electric field. A. G. G.

537.525 : 538.67

587. The absorption of high frequency electromagnetic fields in low pressure discharge tubes. IONESCU, T. V. *Bull. Soc. Roumaine Phys.*, **43** (*No.* 80) 65–83 (1942) *In German.*—The resonance phenomena in a very high freq. circuit, the coil usually consisting of a single turn surrounding a low-pressure hydrogen-filled discharge tube, are investigated theoretically and experimentally. The relation between resonant current and the discharge current is derived, and formulae are given for the calculation of the friction coefficient of the negative ions and the collision probability between electrons and hydrogen molecules at given pressure. A. L.

537.525.4 : 537.521.6

588. Study of the sparking potential in hydrocarbon vapours. III. Xylenes. CONSTANTINESCU, L. *Bull. Soc. Roumaine Phys.*, **41** (*No.* 76) 73–7 (1940) *In French.*—The dependence of sparking potential V (volts) upon pressure p (mm. Hg) and interelectrode distance d (cm) has been investigated for the three isomers of xylene. Al and Cu cathodes were used. The range of values of p and d was 0·5–2·5 mm Hg and 0·1–1·5 cm. For $pd > 0{\cdot}5$, V increases linearly with pd; in this region the three isomers behave similarly. For $pd < 0{\cdot}5$ the sparking potential for *p*-xylene is higher than that for the other isomers; the minimum for *p*-xylene is 20–25 V higher than that for *o*- and *m*-xylene. For Cu cathodes the sparking potential is 10–15 volts higher than with Al cathodes at the same value of pd. A. SCH.

537.525.4 : 537.521.6

589. Remarks on the sparking potentials of the xylenes. CONSTANTINESCU, L. *Bull. Soc. Roumaine Phys.*, **42** (*No.* 77) 29–34 (1941) *In French.*—Comparison is made between the sparking potential curves $V = f(pd)$ for vapourized C_6H_6, toluene and the 3 isomers of xylene. Variations in the minimum sparking potential are attributed to differences in adsorption on the cathode. For values of $pd >$ 0·5 mm Hg cm, $V = kpd$ where k is a constant.

Different values of k are obtained for the different hydrocarbons considered: it is suggested that variation in the value of k is due to variation in the energy exchange processes in mutual collisions of the various hydrocarbon molecules. A. SCH.

537.525.8 : 537.562

590. Townsend coefficients for benzene vapour. BADAREU, E. AND VALERIU, M. *Bull. Soc. Roumaine Phys.*, **42** (*No.* 77) 9–28 (1941) *In German.*—Townsend's α coefficient was determined for C_6H_6 vapour for x/p between 200 and 2 000 V/cm/mm Hg. The γ coefficient was also measured as $f(x/p)$ with a brass cathode. γ was about 3×10^{-6} at $x/p = 1\,000$ V/cm/mm Hg. These results are briefly discussed in relation to data obtained by other workers in simple gases. J. D. C.

537.525.8 : 537.562

591. Townsend coefficients for toluene and benzene vapours. BADAREU, E. AND VALERIU, M. *Bull. Soc. Roumaine Phys.*, **43** (*No.* 79) 35–40 (1942) *In German.*—Describes measurements of Townsend's α and γ coefficients over the range $400 < x/p < 3\,000$ V/cm/mm Hg. J. D. C.

537.527.5

592. On the reduction of the temperatures of high-pressure arcs by increased radiation. GRIGOROVICI, R. *Bull. Soc. Roumaine Phys.*, **41** (*No.* 76) 79–87 (1940) *In German.*—Calculations are made of the excitation temperatures in Hg arcs when Cd or K vapour is introduced. In these cases V_i for the adulterants are less than V_i for the main gas and their introduction lowers the temperature. The theory agrees satisfactorily with the experimental data presented. ($V_i \equiv$ ionization potential.) J. D. C.

X-RAYS 537.531

537.531

593. Effective wavelengths. A new method independent of the measuring material. MUTSCHELLER, A. *Radiology*, **50**, 214–22 (*Feb.*, 1948).—X-ray beam intensities are measured at 3 points in passage of two layers of material of different thicknesses (0·25 and 1·0 mm). The theory is discussed and experimental precautions described. A new definition of effective wavelength is proposed, and the selection of a suitable metal for measurements at any particular wavelength discussed. B. J. L.

537.531 : 531.717

X-ray measurement of thickness of thin films. *See Abstr.* 462

537.531 : 535.33

594. Producing a fiduciary mark on X-ray spectrometer curves. PARSONS, J. AND KNOCH, S. G. Note in *Rev. Sci. Instrum.*, **19**, 722 (*Oct.*, 1948).

537.531 : 535.4 : 548.732.2

On the derivation of Bragg's law. *See Abstr.* 773

537.531 : 535.82 : 537.122

595. Microscope images produced by recoil electrons. RISCO, M. *J. Phys. Radium* (*Sér.* 8) **9**, 150–2 (*April*, 1948) *In French.*—An analogy is drawn between the mechanism of image formation due to secondary electrons and that due to X-rays in the "X-ray microscope" of Heisenberg. These images are attributed to a point source moving with the "equivalent velocity." See also Abstr. 344 (1948). H. J. H. S.

537.531 : 539.26 : 621.386.1

596. On the production and use of very fine X-ray beams, of the order of a few microns. FOURNIER, F. *C.R. Acad. Sci., Paris*, **227**, 833–4 (*Oct.* 27, 1948) *In French.*—The collimators are glass capillaries 2–12 μ in dia., 0·5 to 1 cm long. Specimens are a few $\frac{1}{1000}$ cm thick, distant $\sim$2 cm from the film. Applications are the study of grain boundaries, inclusions, and histological specimens. Exposures are 1–3 hours for a tube with focus 0·01 × 0·2 cm, taking 5 mA at 35 kV. A. J. C. W.

537.531 : 621.386.2 : 669.295

597. The preparation of titanium and vanadium X-ray targets. MCQUILLAN, A. D.; KAY, H. F. Letters in *J. Sci. Instrum. Phys. Ind.*, **25**, 423 (*Dec.*, 1948).

537.531.85

598. The problem of the Compton diffraction in lithium. BARKHATOV, A. *J. Exp. Theor. Phys., USSR*, **18**, 609–13 (*July*, 1948) *In Russian.*—The distribution function of the impulses of the conduction electrons of Li, considering their interaction with the lattice, is used for determining the width of the Compton line of Li. The value is slightly larger than by the Fermi distribution function for free electrons. A.

537.531.9 : 539.164.93

599. Formation of hydrogen peroxide in water irradiated with X-rays and α-particles. BONÉT-MAURY, P. AND LEFORT, M. *C.R. Acad. Sci., Paris*, **226**, 1363–4 (*April* 26, 1948) *In French.*—The quantity of H_2O_2 produced by X-rays in water containing dissolved oxygen increases with the concentration of oxygen, but not linearly with X-ray dose at the higher concentrations. H_2O_2 is produced by α-particles irrespective of the concentration (or even of the presence) of oxygen, and the quantity produced is strictly proportional to the α-particle dose. The mechanisms in the two cases must therefore be different. C. B. A.

CATHODE RAYS . POSITIVE RAYS 537.533/.534

537.533.7 : 548.74

600. Explanation of the Kossel–Möllenstedt electron interference of wide beams on thin foils. FUES, E. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 6–7) 538–56 (1943) *In German.*—Mathematically investigates the electron interference of wide convergent electron beams passing through plane parallel thin crystal foils, first observed by Kossel and Möllenstedt [*Naturwiss.*, **26**, 660 (1938)]. The interference patterns are found to be the direct results of internal interference of those systems of waves in crystals, given by Ewald in the dynamic space-grid refraction theory. The 2-beam case is treated by MacGillavry's method, considerably simplified by using the author's surface of propagation. V. W. R.

537.533.72

601. The focusing in crossed fields of charged particles at relativistic energies. MILLETT, W. E. *Phys. Rev.*, **74**, 1058–63 (*Nov.*, 1948).—The motion of charged particles travelling with relativistic energies in a uniform magnetic field superimposed at right angles to the electric field of a cylindrical condenser has been investigated. Expressions for the angle at which first-order focusing of a divergent beam of particles occurs and first approximations to the line breadth as well as dispersion in velocity, momentum and energy are given. A.

537.533.72 : 531.719.21 : 53.087.24

602. Spatial mensuration of objects in the electron microscope. GOTTHARDT, E. *Z. Phys.*, **118** (*Nos* 11–12) 714–17 (1942) *In German.*—To determine the relative spatial position of points in an object viewed in an electron microscope, stereoscopic photos are required. Ordinary stereoscopic photo mensuration formulae, however, are inapplicable, since electron microscopes give a parallel-perspective picture while optic lenses give central-perspective pictures. Formulae suitable for electron microscopy are developed. Tests with small crystals prove their accuracy. V. W. R.

537.533.9 : 534.22

603. Radiation of an electron or atom moving along the axis of a channel in a dense medium. GINZBURG, V. L. AND FRANK, I. M. *Dokl. Akad. Nauk SSSR*, **56** (*No.* 7) 699–702 (1947) *In Russian.*—(Math.-theor.) In connection with a previous paper [ibid., **56** (*No.* 6) (1947)], the question of the radiation of an electron or atom moving through a dense medium is considered, for the simplest case of motion along the axis of a small-radius channel ($r < \lambda$). The solution arrived at for an electron moving along the axis of a cylindrical channel can be adapted for the more interesting case of motion along the medium-vacuum boundary. The Doppler effect and, particularly, the super-light-speed Doppler effect in dense medium is, in principle, possible when an atom passes along the medium-vacuum boundary, or at a distance of the order $0{\cdot}1\ \lambda$, or less, from that boundary. F. L.

537.533.9 : 621.3.029.6 : 621.385.1

604. Theory of electron-beam h.f. generators. MJAKISHEV, G. Y. *J. Tech. Phys., USSR*, **18**, 1063–8 (*Aug.*, 1948) *In Russian.*—See Abstr. 500 B (1949).

537.534 : 539.155.2 : 545.827

605. An ion "velocitron." CAMERON, A. E. AND EGGERS, D. F., JR. Note in *Rev. Sci. Instrum.*, **19**, 605–7 (*Sept.*, 1948).—A mass spectrometer, similar to that suggested independently by Stephens, is described. Mono-energetic pulses of ions pass through a 3-metre tube to a collector. Heavy ions arrive later than light ones, and an amplifier enables the mass spectra to be displayed; time markers give a mass scale. Test results are given for various ions up to Hg; ion pulse width = 5 μsec, and the observed pulses = 20–30 μsec—the time between Hg^{++} and $Hg^{+} \simeq 50$ μsec. Analysis of mixtures of rapidly changing composition is possible. T. G. P.

537.534 : 621.384.6

606. Electromagnetic deflector for the beam of the 184-inch cyclotron. POWELL, W. M., HENRICH, L. R., KERNS, Q. A., SEWELL, D. C. AND THORNTON, R. L. *Rev. Sci. Instrum.*, **19**, 506–12 (*Aug.*, 1948).—Abstr. 165 B (1949).

537.534.087.4 : 621.384.6

607. A simple recording system for a mass spectrometer. DIBELER, V. H., BERNSTEIN, R. B. AND TAYLOR, T. I. Note in *Rev. Sci. Instrum.*, **19**, 719–20 (*Oct.*, 1948).

537.534.74 : 537.133

608. On the anisotropy of proton-proton scattering at 14·5 Mev. LOPES, J. L. *An. Acad. Brasil Ciênc.*, **20** (*No.* 1) 69–73 (1948) *In English.*—The angular distribution is calculated using the Möller-Rosenfeld mixed symmetrical meson theory, and the Born approx., for 3 meson masses. Best agreement with absolute cross-sections is obtained for a meson mass of 250, but the calculated angular variation is rather large. G. J. K.

537.534.74 : 539.152.1

609. Theory of scattering of fast charged particles. II. Plural and multiple scattering. MOLIÈRE, G. *Z. Naturforsch.*, **3a**, 78–97 (*Feb.*, 1948) *In German.*—From the theory of single scattering [Abstr. 3225 (1947)], the angular distribution for (plural) incoherent scattering in a thin foil is obtained as an integral. For a thick foil (multiple scattering) a series development is used which gives the scattering for all angles as a function of the mean number of collisions made in the foil. Comparison of theoretical with experimental values is limited by the wide spread in the latter. A. P. F.

DISCHARGE TUBES . COUNTERS 537.54

537.542

610. A counter for low energy ionizing particles. THOMAS, H. C. AND UNDERWOOD, N. *Rev. Sci. Instrum.*, **19**, 637–9 (*Oct.*, 1948).—A counter which combines large solid angle, low operating voltage, ease of changing source, and ability to detect particles of very low energy is described. By means of a revolving plate a sample may be rotated to a position inside the counting chamber through which helium is slowly passing. A large solid angle with low operating voltage is achieved by placing side by side several semi-cylindrical cathodes whose central wires are electrically connected. Fe^{65}, which has a half-life of 4 yr, was used as a sample with which to examine the operational characteristics of the counter. A.

537.542 : 535.33.03

611. Construction of a discharge tube producing the atomic spectrum of hydrogen. VAN OORT, W. P. AND VAN HEEL, A. C. S. *Rev. Opt.* (*Théor. Instrum.*) **27**, 431–4 (*July*, 1948) *In French.*—The method of obtaining the atomic spectrum of H by means of a discharge in H_2O vapour according to Arnulf and Dunoyer [*Rev. Opt.*, **9**, 510 (1930)] has been improved by adding a container with a concentrated aqueous solution of NaOH to maintain the water vapour at constant pressure, and an electrically heated Pd tube to eliminate such H_2 as may be formed during the discharge. A discharge tube of this kind gave atomic lines of H, almost without any continuous light, in a capillary space 8 cm long and 3 mm bore, with tap-

water cooling. The construction enables end-on radiation to be used. Currents of 300 mA at 400 W are recommended for operating the lamp, but for shorter periods higher currents may be used. In another model the generated H_2 is absorbed by CuO. F. L.

537.542 : 539.166

612. A multiple γ-ray counter of twenty sections. PRINGLE, R. W. Letter in *J. Sci. Instrum. Phys. Ind.*, **25**, 423–4 (*Dec.*, 1948).

IONIZATION . THERMIONICS 537.56/.58

537.56

613. A high-pressure hydrogen-filled ionization chamber. STAFFORD, G. H. Letter in *Nature, Lond.*, **162**, 771–2 (*Nov.* 13, 1948).—The construction and use of a chamber in which electron collection is achieved up to ~90 atm. pressure are described. The chamber has high efficiency (17% for 2·2 MeV neutrons) and can be used for analysing neutron spectra up to ~13 MeV. Pulse-size distributions obtained with neutrons from D–D, D–Li, D–Be and D–N reactions are given. A. P. F.

537.56

614. Ionization chamber technique. WINOGRADOFF, N. *J. Sci. Instrum. Phys. Ind.*, **25**, 432–4 (*Dec.*, 1948).—Following a brief description of the fundamental structure of ionization chambers, the limitations of the accuracy of radiation intensity measurements, due to the "soaking in" of charge into the insulator, are discussed, and a method of greatly reducing this effect by suitable design of the electrode assembly is described. A.

537.562 : 535.354

615. Nitrogen afterglow. MITRA, S. K. Letter in *Nature, Lond.*, **162**, 774 (*Nov.* 13, 1948).—Differentiates between the long- and short-lived afterglows in nitrogen. The former are explicable if the active particles are $N_2^-(X')$ ions, but the latter, besides involving $N_2^-(X')$, also need other particles such as $N_2^+(A')$, N and N′. J. D. C.

COSMIC RAYS 537.591

537.591

616. Disintegration of mesotrons in B^{10}. NERESON, N. G. Letter in *Phys. Rev.*, **74**, 509 (*Aug.* 15, 1948).—The decay rate of mesons was measured for B^{11} and B^{10} in identical geometries in order to detect any difference in the capture probability for negative mesons. No significant difference between decay characteristics in the two isotopes was found, the capture probability in both being very small. J. G. W.

537.591 : 523.5

617. Rate of production of helium in meteorites by cosmic radiation. BAUER, C. A. Letter in *Phys. Rev.*, **74**, 501–2 (*Aug.* 15, 1948).—The He-content of five meteorites from S.W. Africa, probably members of the same fall, is discussed in terms of the production of He in meteorites by cosmic rays. J. G. W.

537.591 : 778.39

618. On the use of nuclear plates in a magnetic field. BARBOUR, I. G. Letter in *Phys. Rev.*, **74**, 507 (*Aug.* 15, 1948).—Powell and Rosenblum [Abstr. 2206 (1948)] have suggested the measurement of the sign and mass of cosmic-ray particles by placing two parallel photographic emulsion surfaces separated by an air gap perpendicular to a magnetic field. Modifications of this method are suggested. Instead of using a reflection microscope (Burch type) with large working distance, an ordinary microscope can be applied for measurement by using photographic emulsions coated on both sides of 50–150 μ thick glass plates or on acetate film support. If several double-coated plates separated by air gaps are stacked as a sandwich, more than one curvature measurement of the same particle can be made. An air gap of 2 000 μ is suggested. For a path length of 10 000 μ in air and a field of 12 500 gauss the theoretical deflection of a 200 m_e meson of energy 4·5 MeV is 625 μ, for 1·2 MeV, 1 250 μ. Measurement of magnetic deflection and matching of the superposition of the plates is done by means of a projection microscope. R. H. H.

537.591.08

619. The development and application of new techniques in meson research. CALLISEN, F.-I. *Z. Naturforsch.*, **2a**, 686–97 (*Nov.–Dec.*, 1947) *In German.*—Technical developments in the study of mesons (particularly from recent English and American sources) are summarized under the headings: Methods of measurement—counters, cloud chamber, photographic emulsion, Čerenkov counters. Evaluation of results—ionization by charged particles, absorption of mesons, errors in mass determinations due to multiple scattering, interpretation of tracks in emulsions. J. G. W.

537.591.1

620. A neutral component of cosmic rays not forming showers and in the horizontal direction. ROGOZINSKI, A. *C.R. Acad. Sci., Paris*, **227**, 628–9 (*Sept.* 27, 1948) *In French.*—A horizontal triple counter telescope is shielded against shower counts. While Pb absorbers between the extreme counters lead to considerable reduction of counting rate, absorbers up to 15 cm Pb placed beyond the extreme counters produce an insignificant effect. A neutral component in the horizontal beam is proposed, the secondaries of which compensate for the horizontal ionizing particles removed by an absorber outside the extreme counters of the telescope. J. G. W.

537.591.15

621. A study of cosmic-ray bursts. BRIDGE, H. S., HAZEN, W. E., ROSSI, B. AND WILLIAMS, R. W. *Phys. Rev.*, **74**, 1083–102 (*Nov.*, 1948).—A "fast" ionization chamber, suitable for the investigation of cosmic-ray bursts, is described. The operation of the chamber and of the associated electronic circuits is discussed. The nature of the cosmic-ray events responsible for the production of ionization bursts was studied (*a*) by observing coincidences between several ionization chambers, (*b*) by analysing the shape of the ionization pulses, (*c*) by operating an ionization chamber inside a cloud chamber which was expanded whenever the

ionization chamber recorded a pulse. The experimental results led to the following conclusions: (1) at mountain altitudes 98% of the ionization pulses in an unshielded chamber of the type used are produced by nuclear disintegrations, the remaining 2% by air showers; (2) in the nuclear disintegrations, heavily ionizing particles of sufficiently high energy are produced to cause coincidences between neighbouring chambers; (3) nuclear disintegrations are produced mainly by non-ionizing rays, which are possibly neutrons, certainly not photons; (4) about 12 in Pb is necessary to reduce the intensity of the radiation which produces nuclear disintegrations to $1/\varepsilon$ times its original value. A.

537.591.15 : 539.16.08

622. An investigation of the pulses in proportional counters caused by cosmic rays. PODGORETSKY, M. I. AND SHCHERBAKOVA, M. N. *Dokl. Akad. Nauk SSSR*, **60** (*No.* 9) 1527–9 (1948) *In Russian.*—A more detailed investigation of the connection between the nuclear fission produced by cosmic rays and narrow showers, leading to the conclusion that the effect depends on the substance in which generation proceeds. The value of the current for the generating component is investigated and determined. L. J. G.

537.591.15/.2

623. The energy distribution in cosmic-ray showers. RICHARDS, J. A., JR. AND NORDHEIM, L. W. *Phys. Rev.*, **74**, 1106–13 (*Nov.* 1, 1948).—The track length distribution $f(E)dE$ in a shower is defined as the total distance travelled by all electrons while in the energy interval dE. It is representative for the average energy distribution in a shower. The present paper obtains by numerical methods the complete functions for both electrons as well as for photons in showers of high primary energy. Calculations have been made for air and for Pb, down to energies of about 4 MeV. Close approximations to the actual cross-sections have been used for all energies and all physically significant processes have been included—radiation, pair production, energy loss through collision, Compton effect, and knock-on electrons. The large number of low-energy photons that accompany a shower, a quantity here evaluated for the first time, is discussed. A.

537.591.5

624. Sea level latitude effect of cosmic radiation. MORRIS, P. A., SWANN, W. F. G. AND TAYLOR, H. C. *Phys. Rev.*, **74**, 1102–5 (*Nov.* 1, 1948).—On a recent voyage from Rio de Janeiro to Boston the vertical intensity of the total and hard components of the cosmic radiation were measured with a Geiger counter telescope apparatus. For the hard component the percentage alteration from high latitudes to the magnetic equator was $5{\cdot}32 \pm 0{\cdot}46\%$. For the soft component it was $4{\cdot}46 \pm 0{\cdot}61\%$ and for the total radiation it was $5{\cdot}04 \pm 0{\cdot}55\%$. A.

537.591.5 : 523.72

Cosmic rays from the sun. *See Abstr.* 419

537.591.5 : 537.591.15

625. Further data concerning the variation of penetrating showers with altitude. TINLOT, J. Letter in *Phys. Rev.*, **74**, 1197–8 (*Nov.* 1, 1948).—In addition to confirming previous results [Abstr. 3818 (1948)], it is shown that only about 10% of penetrating showers are associated with the discharge of an unshielded tray of counters (sensitive to atmospheric cascades) of area equal to that of each level of the penetrating shower system. J. G. W.

MAGNETISM 538

538.082 : 537.533.72 : 621.385.8

626. Electron optical observation of magnetic fields. MARTON, L. Letter in *J. Appl. Phys.*, **19**, 863–4 (*Sept.*, 1948).—The electron optical "Schlieren" effect is used for the quantitative measurement of the magnetic field strength close to a magnetized steel wire by observing the displacement of the image of the wire. By suitably placing a grid network, a complete picture of the extended magnetic field can be obtained. H. J. H. S.

538.082 : 621.317.44

627. Cathode-ray magnetization curve tracer. SCHERB, M. V. *Rev. Sci. Instrum.*, **19**, 411–19 (*July*, 1948).—Abstr. 428 B (1949).

538.082/.083 : 550.382

628. The measurement of magnetic properties of rocks. BRUCKSHAW, J. MCG. AND ROBERTSON, E. I. *J. Sci. Instrum. Phys. Ind.*, **25**, 444–6 (*Dec.*, 1948).—An apparatus for the measurement of the magnetic susceptibility of rocks in a field of 0·5 oersted is described, together with one for the determination of the direction and intensity of the residual magnetism. A.

538.113 : 548.7

629. Curie temperature and hydrostatic pressure. KORNETZKI, M. *Z. Phys.*, **124** (*Nos* 7–12) 566–9 (1948) *In German.*—From experimental results on metallic halides the variation of Curie temperature with the ratio of the lattice constant to the radius of the 3*d* ring can be deduced. From this the variation of the Curie temperature of Fe with lattice constant, and hence with pressure, can be obtained. The result is in general agreement with earlier predictions. A. E. DE B.

538.114 : 538.27 : 530.145

630. The temperature-dependence of the initial susceptibility of nickel under tension. DÖRING, W. *Z. Phys.*, **124** (*Nos* 7–12) 501–13 (1948) *In German.*—The theory of spin waves in a ferromagnetic material is used to calculate the temperature-dependence of the initial susceptibility of Ni under tension. It is shown that for constant strain the susceptibility should increase as the temperature increases in the same way as the saturation magnetization decreases. A. E. DE B.

538.114 : 538.65

631. On the theory of the magnetization of an elastically distorted 25% Cr–Fe alloy. RÜDIGER, O. *Z. Phys.*, **124** (*Nos* 7–12) 458–68 (1948) *In German.*—The influence of mechanical strains on the spin distribution in a 25% Cr–Fe alloy, in which only one magnetoelastic constant differs from zero, is considered. The spins set themselves always along the cube edges. A. E. DE B.

538.12 : 536.48

632. Magnetic measurements. SHOENBERG, D.

Rep. Internat. Conf. "*Low Temperatures*" (1946) (*Phys. Soc., Lond.*) *II*, 85–6 (1948).—A method of measuring magnetic moments at liquid He temps. is described. G. L. W.

538.222 : 536.48

633. Pseudo-ferromagnetic phenomena in paramagnetic crystals at low temperatures. BECQUEREL, J. AND LE GRAND, Y. *Rep. Internat. Conf.* "*Low Temperatures*" (1946) (*Phys. Soc., Lond.*) *II*, 134–6 (1948).—At liquid H temperatures pseudo-ferromagnetic phenomena have been observed in paramagnetic substances. Results on the paramagnetic rotation of the plane of polarization as a function of applied magnetic field are given for natural crystals of ferrous carbonate. A. E. DE B.

538.23

634. Relaxation and hysteresis effects in paramagnetic salts. TEMPERLEY, H. N. V. *Rep. Internat. Conf.* "*Low Temperatures*" (1946) (*Phys. Soc., Lond.*) *II*, 144–7 (1948).—A review of the explanations of the irreversible heating effects which occur when a paramagnetic alum is subjected to an alternating magnetic field. Some possible sources of time lags between field and magnetic moment are considered. A. E. DE B.

538.247 : 536.48

635. The technique of adiabatic demagnetization. HULL, R. A. *Rep. Internat. Conf.* "*Low Temperatures*" (1946) (*Phys. Soc., Lond.*) *II*, 72–84 (1947).—Describes the salient features of the technique developed at Oxford for investigations in the low-temperature range obtained by the magnetic method. Main sections of the paper describe: (I) the attainment of the low temperature and measurement of the temperature on an arbitrary scale; (II) the conversion to the absolute scale, and the derivation of the specific heat of the cooling substance; (III) experiments on other substances. An appendix describes a Simon expansion liquefier for helium, and its use in a demagnetization experiment. A.

538.248

636. On magnetic remanence. BOZORTH, R. M. *Z. Phys.*, **124** (*Nos* 7–12) 519–27 (1948) *In English.*—For many materials the ratio of retentivity to magnetization at saturation is about 0·5, and this is accounted for by simple domain theory. In some materials, however, this fraction is much smaller and explanations of this fact are discussed. It is suggested that in certain cases the Bloch walls may become so thick that the domain structure in the specimen disappears. A. E. DE B.

ELECTROMAGNETISM . ELECTRODYNAMICS 538.3/.5

538.32 : 538.56

637. On the attraction between two perfectly conducting plates. CASIMIR, H. B. G. *Proc. K. Ned. Akad. Wet.*, **51** (*No.* 7) 793–6 (1948) *In English.*—Currents are induced in the plates, when placed in an electromagnetic field. The attraction between them is found by the method of a previous paper [Abstr. 1286 (1948)], and is found to be $0{\cdot}013 \times a^{-4}$ dyne cm^{-2}, where a is the distance in microns between the plates. It is concluded that there is an attractive force between 2 metal plates, which is independent of the material of the plates, as long as the distance, a, is so large, that for a wavelength $\simeq a$, the penetration depth $\ll a$. The force is interpreted as a zero point pressure of electromagnetic waves. L. S. G.

538.56 : 621.317.36 : 535.33.072

A grating spectrometer for millimeter waves. *See Abstr.* 526

538.566.2 : 621.396.11

638. The propagation of electromagnetic waves in stratified media. ABELÈS, F. *Ann. Phys., Paris* (*Sér.* 12) **3**, 504–20 (*July–Aug.*, 1948) *In French.*—The system of linear equations for the determination of the field components is solved by means of recurrence relations. Formulae are given for the reflection and transmission coefficients. L. P.

538.566.3 : 621.396.11

639. Transformation of the type of polarization and triple splitting in the propagation of signals in the ionosphere. VINOGRADOVA, M. B. *Izv. Akad. Nauk SSSR, Ser. Fiz.*, 12 (*No.* 3) 288–92 (1948) *In Russian.*—See Abstr. 547 B (1949).

MAGNETIC EFFECTS 538.6

538.61

640. Magnetic rotatory power of titanic chloride. DE MALLEMANN, R. AND SUHNER, F. *C.R. Acad. Sci., Paris*, **227**, 546–7 (*Sept.* 13, 1948) *In French.*—The magnetic rotatory power of $TiCl_4$ is an exception to the de Mallemann rotativity rule. The ratio of the specific rotations of vapour and liquid is <1, but deviates widely from the refractive index of the liquid. C. B. A.

538.61

641. Rotativities of $SiCl_4$ and of C_6H_{12} vapours. DE MALLEMANN, R. AND SUHNER, F. *C.R. Acad. Sci., Paris*, **227**, 804–5 (*Oct.* 27, 1948) *In French.*—The measured magnetic rotativities of $SiCl_4$ and of C_6H_{12}, vapour and liquid, are in agreement with de Mallemann's additivity theory. C. B. A.

538.61

642. The Faraday effect and the structure of thin layers of iron. KÖNIG, H. *Optik*, **3** (*Nos* 1–2) 101–19 (1948) *In German.*—Measurements are described of the Faraday effect in thin layers of Fe produced by evaporation *in vacuo*. The effects of oxidation and of recrystallization are described and the results of examination of the discs by electron diffraction are given. A. E. DE B.

538.614 : 537.12

643. Faraday effect in a relativistic electron gas. SEROVA, F. G. *J. Exp. Theor. Phys., USSR*, **18**, 780–4 (*Sept.*, 1948) *In Russian.*—The rotation of the plane of polarization in a relativistic electron gas is investigated. It is shown that this rotation is always diamagnetic, although the nature of the electron gas is always paramagnetic. The non-relativistic expression of the rotational property is seen to be accurate up to very high electron velocities. A.

538.632.08

644. Improved method for measuring Hall coefficients. ISENBERG, I., RUSSELL, B. R. AND GREENE, R. F. *Rev. Sci. Instrum.*, **19**, 685–8 (*Oct.*, 1948).—The influence of the current electrodes on measurements of the Hall coefficient is examined. Equations are given for the ratio of the measured voltage as a function of the geometry of the sample. Experiments verifying these results are described. The conditions for maximum sensitivity are given. A.

538.65 : 539.32

645. Influence of orientation on the magnetic change in Young's modulus in a single-crystal invar foil. BOUCHET, P.-J. *C.R. Acad. Sci., Paris*, **227**, 904–6 (*Nov.* 3, 1948) *In French.*—The increase in Young's modulus, measured by a small Chevenard extensometer, in a field of 250 gauss is $\sim 0 \parallel [100]$, $18\% \parallel [110]$. The [111] direction was not investigated. A. J. C. W.

MOLECULAR STRUCTURE 539.13

539.13 : 541.651 : 535.343.1–15

Infra-red spectrum and structure of trioxane. *See Abstr.* 530

539.132

646. A tabulation of general formulas for inverse kinetic energy matrix elements in acyclic molecules. DECIUS, J. C. *J. Chem. Phys.*, **16**, 1025–34 (*Nov.*, 1948).—In terms of internal co-ordinates of the bond stretching and bending type, together with a torsional type of co-ordinate, general formulae for inverse kinetic energy matrix elements have been computed for all 33 possible acyclic configurations involving the given types of co-ordinates. Tabulations are given both for the general case and for three special cases in which all valence angles of the configuration are assumed to be 90°, 109° 28′ and 120°, respectively. A.

539.132 : 535.338.4 : 535.343.32/.4

647. The mechanism of the molecular fields of di-derivatives of benzene. SCHÜLER, H. *Z. Naturforsch*, **3a**, 313–22 (*June*, 1948) *In German.*—Based on results of emission and absorption spectra in solution and in the gas-phase, a co-ordination of the observed spectra has been found. In di-derivatives of benzene having a C = O group in conjugation in the ring and having as a secondary substituent a NH_2, O . CH_3, or CH_3 group the spectroscopic variety of the phenomena can be explained by the interplay of three effects: (*a*) An "*S*-effect" which causes an increase in the transition probability of the CO excitation with *o*- and *m*-derivatives, and also a violet displacement in the benzene ring excitation with *o*-, *m*- and *p*-derivatives. (*b*) A H-bridge linkage is obtained at the *o*-position with substances of similar grouping. (*c*) In solution, but not in the gas-phase, and only in the *p*-derivatives, a "double molecule" structure has been observed. Definitions of the three effects are given. B. E. E.

539.132 : 535.343.4–14

648. Additional rotational energy levels of H_2O and D_2O molecules. GINSBURG, N. *Phys. Rev.*, **74**, 1052–7 (*Nov.* 1, 1948).—An extension of the pure rotational energy levels for H_2O and D_2O is made in order to obtain new possible microwave transitions. For H_2O the levels are given through $J = 14$ and for D_2O through $J = 15$. Additional assignments are made in the previously observed absorption spectra. The Wang secular determinant for the asymmetric rotator is expanded, and equations for the energy levels of $J = 12$, 13, 14 and 15 are given in terms of the asymmetry parameter. A.

539.132 : 541.1 : 536.654

649. On the thermochemistry of organic compounds. VALATIN, J. G. *J. Chem. Phys.*, **16**, 1018–24 (*Nov.*, 1948).—A discussion of different arguments on the dissociation energy of CO and on the role of the ^5S state of carbon is given. The consistency of the 169·735 kcal/mole value of the heat of sublimation of carbon into ^5S carbon atoms given by Gerö is shown, in spite of some arguments of Long and Norrish. The energy required to rupture ethane into two methyl radicals results in $\{C - C\}_{ethane} = 82{\cdot}78$ kcal/mole, in excellent agreement with the value which can be obtained by a cycle proposed by Van Artsdalen without the use of the heat of sublimation value of carbon. The difference of the mean C — C bond energies in diamond and in the higher members of the paraffin series is 2·04 kcal/mole. The energy required to rupture the double bond in 1-heptene, $\{C = C\}_{1\text{-heptene}} = 145{\cdot}43$ kcal/mole, in 2-methyl-1-butene $\{C = C\}_{2\text{-methyl-}1\text{-butene}} = 148{\cdot}70$ kcal/mole. In the acetylene hydrocarbons $\{C \equiv C\}_{1\text{-pentene}} = 198{\cdot}67$ kcal/mole, $\{C \equiv C\}_{acetylene} = 194{\cdot}28$ kcal/mole. A.

539.132 : 541.57

650. Dissociation schemes of some carbonyl compounds. GERÖ, L. AND VALATIN, J. G. *J. Chem. Phys.*, **16**, 1014–17 (*Nov.*, 1948).—Dissociation schemes and bond energies are given for formaldehyde, acetaldehyde, acetone and ketene. The distinction between dissociation term combinations which belong or do not belong to the lowest electronic state of the molecule is stressed, only energies corresponding to the former being in connection with bond energies. The survey of the different energetic possibilities may contribute to a better understanding of photo-chemical processes. A.

539.132 : 541.6

651. Electron levels of styrol molecule and general method of setting up secular equations. BLUMENFELD, L. A. *J. Exp. Theor. Phys., USSR*, **18**, 837–9 (*Sept.* 1948) *In Russian.*—The electron singlet levels of the styrol molecule are calculated on the method of localized pairs. The general method of setting up secular equations from symmetry and for an arbitrary base of the canonic structure is explained. A.

539.132/.3 : 536.7

652. Thermodynamic functions for tritium and tritium hydride. The equilibrium of tritium and hydrogen with tritium hydride. The dissociation of tritium and tritium hydride. JONES, W. M. *J. Chem. Phys.*, **16**, 1077–80 (*Nov.*, 1948).—The heat capacity, entropy, internal energy, and free energy are calculated to 2 500°C for T_2 and TH. The distribution of T_2 between the ortho and para states is considered

The equilibrium constant for the formation of TH from H and T is calculated from 50°K to 2 500°K. The dissociation of T_2 and TH into the atoms is discussed. The bearing of the radioactivity of T* and T*H on the attainment of thermodynamic equilibrium is briefly considered. A.

539.132/.3 : 548.7 : 541.57

653. The binding energy for a self-trapped electron in NaCl. MARKHAM, J. J. AND SEITZ, F. *Phys. Rev.*, **74**, 1014–24 (*Nov.* 1, 1948).—A calculation has been made of the binding energy of a self-trapped electron in NaCl. The potential well, caused by the ionic displacements, was assumed to be a sawed-off Coulomb field, the sides being given by $(1/\kappa_0 - 1/\kappa)1/r$, where the κ's are the dielectric constants. The depth of the well was calculated by the method of Mott and Littleton. In the present problem, however, we require a self-consistent solution; that is, the initial wave function which is employed in calculating the depth of the trapping potential hole must be identical to the one obtained from this potential hole on solving the Schroedinger equation. The electron is distributed over a sphere whose radius $\simeq$ three interatomic distances. The outer displacements are calculated by a semicontinuum theory, whereas the dipoles of the three ions nearest the trapping centre are calculated from the condition of equilibrium. The optical dissociation energy is found to be 0·68 eV, whereas the thermal energy is 0·13 eV. The low value of the second quantity presumably explains why self-trapping has not been observed to date. This energy should be about twice as large in LiF. These results suggest that self-trapping should be sought at a very low temperature. A.

539.133 : 541.123.5

654. Spectroscopy and thermodynamics. I. Moments of inertia of methyl bromide. II. Equilibrium constants of the reaction $CH_3Br + HCl \rightleftharpoons CH_3Cl + HBr$; moments of inertia of methyl bromide. BAK, B. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **24** (*No.* 9) 35 *pp.* (1948) *In English.*—Comparisons of entropy of CH_3Br from heat capacity data and from infrared spectra lead to values of the moments of inertia which are compared with direct spectroscopic values. From experimental study of the equilibrium $CH_3Br + HCl \rightleftharpoons CH_3Cl + HBr$ at various temperatures the larger moment of inertia for CH_3Br is deduced, using the spectroscopic value for CH_3Cl. The heat of the above reaction is calculated, and it is suggested that Thomsen's values for the heats of formation of CH_3Br and CH_3Cl may be incorrect. A. G. G.

539.133 : 541.57 : 539.153

655. Bond energies of hydrocarbons. GERÖ, L. *J. Chem. Phys.*, **16**, 1011–13 (*Nov.*, 1948).—The spectroscopical dissociation scheme of CO gives for the heat of sublimation of C into ^5S carbon atoms $L_c = 169\,735$ kcal/mole. This means an 84·58 kcal/mole average bond energy in diamond. The C — H bond energy of the methylene radical is 97·02 kcal/mole, the strength of the paraffinic C — C bond 82·59 kcal/mole, the olefinic double bond C = C is 145·12 kcal/mole. The rupture of successive bonds in methane requires 100·76, 97·36, 97·02, 97·02 kcal/mole. A.

539.152 : 537.122

656. The *g*-factor of the orbital moment of the electron. KOPPE, H. *Z. Naturforsch.*, **3a**, 310 (*May*, 1948) *In German.*—It is pointed out that part, at least, of the deviation from an exact integral or half-integral value for the *g*-factor [Abstr. 2614 (1947); 702, 1030 and 3860 (1948)] is a consequence of the fact that the electron revolves not about the nucleus, but about the common centre of mass. A. P. F.

539.152.1

657. Nuclear physics in certain European countries during the period 1939–1945. MANNEBACK, C. *Rel. Pont. Acad. Sci.* (*Auct. Sci. Temp. Belli*) (*No.* 9) 15 *pp.* (1939–45) *In French.*—Survey of work in U.K., Belgium, Denmark, Germany, Netherlands and Switzerland. 12 pages of bibliography (partly short abstracts).

539.152.1

658. On the form of the signals observed with a nuclear inductor. GIULOTTO, L. *Nuovo Cim.*, **5**, 498–504 (*Oct.*, 1948) *In Italian.*—Relates the form of signals of protons in H_2O obtained with a nuclear inductor in different experimental conditions. The form of the signals corresponds to Bloch's theory. A.

539.152.1

659. On nuclear dipole vibrations. GOLDHABER, M. AND TELLER, E. *Phys. Rev.*, **74**, 1046–50 (*Nov.* 1, 1948).—The high-frequency resonances recently observed for (γ,n) reactions as well as photo-fission are interpreted in analogy with the "reststrahl frequencies" of polar crystals. The estimated frequencies are in good agreement with the experimental results. An interesting consequence of this interpretation is the conclusion that strong resonance scattering of γ-rays should take place at a frequency characteristic of the scattering nucleus. A.

539.152.1 : 535.343.4–14

660. Nuclear spins and quadrupole moments of B^{10} and B^{11}. GORDY, W., RING, H. AND BURG, A. B. Letter in *Phys. Rev.*, **74**, 1191 (*Nov.* 1, 1948).—Measurements on the microwave spectrum of BH_3CO for the $J_1 \rightarrow {}_2$, $K_0 \rightarrow {}_0$ and $K_1 \rightarrow {}_1$ transitions near 35 000 Mc/s indicate a symmetrical top configuration. The quadrupole splitting agrees with B^{10} spin 3, coupling $-3{\cdot}30 \pm 0{\cdot}10$ Mc/s and B^{11} spin 3/2, coupling $-1{\cdot}55 \pm 0{\cdot}08$ Mc/s. D. H. W.

539.152.1/.2 : 539.181.2

661. The nuclear spin and magnetic moment of Na^{22}. DAVIS, L. Letter in *Phys. Rev.*, **74**, 1193 (*Nov.* 1, 1948).—The atomic beam magnetic resonance method, adapted for weakly abundant isotopes by the inclusion of a mass spectrometer and a Be–Cu multistage electron multiplier, has been applied to Na^{22} giving spin 3, h.f.s. $\Delta\nu$ 1 220·64 ± 0·04 Mc/s and a nuclear magnetic moment of $+1{\cdot}746 \pm 0{\cdot}003$ nuclear magnetons obtained by comparison with Na^{23}. D. H. W.

539.152.2

662. The magnetic moment of H_3 and He_3 according to the Møller–Rosenfeld theory of nuclear forces. VILLARS, F. AND THELLUNG, A. *Helv. Phys. Acta*, **21**

(*No.* 5) 355–64 (1948) *In German.*—A theoretical discussion of the experimental values for the magnetic moments of H_3 and He_3 is attempted. $\mu_{H_3} = 2{\cdot}979$ SBM [Abstr. 1593, 1927 (1947)], $\mu_{He_3} = (-2{\cdot}13 \pm 0{\cdot}02)$ SBM [Abstr. 1592 (1947)]. Assuming tensor forces Rarita and Schwinger [Abstr. 1076 (1941)] have previously obtained theoretical results. The experimental values differ from the theoretical ones by 0·271 SBM for H_3 and by $(-0{\cdot}27 \pm 0{\cdot}02)$ SBM for He_3. Corrections of corresponding sign should be obtained by considering charge exchange in the nucleus. The authors calculate ground state and exchange contributions by means of nuclear forces of the Møller–Rosenfeld type. A zero-th and 1st approximation for the ground state is obtained by variational methods using Fröhlich's [Abstr. 3278 (1947)] coupling parameters. The exchange contribution to the magnetic moment is redetermined and found in agreement with previous results by Møller and Rosenfeld [*K. Danske Vidensk. Selsk.*, **20**, *No.* 12 (1943)] thus contradicting results by Ma and Yu [Abstr. 3090 (1942)]. It is concluded that the M–R forces are not very suitable for the interpretation of experimental results. This is attributed to the absence of *D*-state contamination in the M–R theory, but in view of the present uncertainty regarding the ground states of H_3 and He_3, nuclei the investigation was not extended to *D*-states. (SBM = small Bohr magnetons. H. MO.

539.152.2 : 538.113 : 535.338.32

663. Line shapes in nuclear paramagnetism. PAKE, G. E. AND PURCELL, E. M. *Phys. Rev.*, **74**, 1184–8 (*Nov.* 1, 1948).—This note discusses briefly several methods of describing the width and shape of the resonances characteristic of nuclear paramagnetism. Use of the so-called moments of the shape function is illustrated by an experimental determination of a root mean square line width which is in substantial agreement with a calculation by Van Vleck. The solutions of the Bloch equations, which lead to the Lorentz shape function traditional in the theory of radiation- and collision-broadened lines, are compared with susceptibility curves based on a Gauss absorption curve. A significant difference between the two dispersion curves serves as a criterion for determining whether or not either of these two shapes closely approximates to a given experimental curve, and experimental examples of each are given. For comparison of shape functions, several well-known specializations of the Kronig–Kramers relations are employed. The collection of these formulae may incidentally prove convenient and useful to those engaged in studies of nuclear paramagnetism. A.

539.152.2 : 539.165

664. Note on the spins of nuclei of mass number ten. GOLDHABER, M. *Phys. Rev.*, **74**, 1194 (*Nov.* 1, 1948).—The nuclear spins $I = 0$, 3 and 0 are suggested for Be^{10}, B^{10}, C^{10} respectively. These give reasonable explanations of the long life of Be^{10} against β-decay, the decay of C^{10}, and the reaction $B^{10}(d,\alpha)Be^{8}$. $I = 3$ for B^{10} is not inconsistent with the measured magnetic moment. G. J. K.

539.153 : 535.33

665. Atomic energy levels. MOORE, C. E. *Circ. U.S. Bur. Stand.* (*No.* 467) 75 *pp.* (1948).—The firs of a series of pamphlets in which it is aimed to recor all energy levels derived from observations of atomi spectra. The elements treated here are H I, D, He I He II, Li, Be, B, C, N, O and F. A bibliography i given in each case. L. S. G.

539.153.4 : 538.5

666. Some observable effects of the quantum mechanical fluctuations of the electromagnetic field. WELTON, T. A. *Phys. Rev.*, **74**, 1157–67 (*Nov.* 1 1948).—An intuitive explanation is given for the electromagnetic shift of energy levels by calculating the mean square amplitude of oscillation of an electron coupled to the zero-point fluctuations of the electro magnetic field. The resulting disturbance of the charge and current density of the electron gives rise to various observable effects which can be estimated in a simple classical fashion. The effects treated are the Lamb shift, the correction to the *g*-factor for the orbital and spin angular momenta of the electron and the correction to the Compton scattering cross section at low energies. A simple explanation is also given for the peculiar ultraviolet divergence noticed by Pauli and Fierz in their treatment of the infrared paradox. A

539.154.2 : 54

667. Research on element 85. HULUBEI, H. *Bull Soc. Roumaine Phys.*, **45** (*No.* 82) 3–7 (1944) *In French.*—Short survey of the author's and othe workers' contributions on the existence of element 85 Bibliography of 11 titles.

539.155.2 : 533.15 : 541.123.

668. Concentration of N^{15} in a gaseous exchange column. TAYLOR, T. I. AND SPINDEL, W. Letter in *J. Chem. Phys.*, **16**, 635 (*June*, 1948).—The metho of chemical exchange in the gas phase for the separa tion of isotopes [Abstr. 3613 (1947)] is applied to the exchange equilibrium in NO_2/NO. Since NO dissociates thermally into $NO + \frac{1}{2}O_2$ the metho consists simply in introducing NO_2 into a therma diffusion tube. No chemical conversion is required at the ends of the tube. With a tube of 0·9 cm i.d 200 cm length and a Pt wire of 0·64 mm dia. a 500°C an equilibrium overall separation of 2·7, 3· and 1·72 was obtained at gas pressures of 1·0, 0·5 0·25 ats. respectively, the N^{15} being enriched at the bottom of the tube. H. L.

539.155.2 : 539.167.

669. A mass spectrograph for radioactive isotopes. LEWIS, L. G. AND HAYDEN, R. J. *Rev. Sci. Instrum.* **19**, 599–604 (*Sept.*, 1948).—The mass spectrograph described for the separation of small quantities o isotopes, allows a direct determination of the mass numbers of radio-isotopes. It also permits the determination of the radiation characteristics of each of several radio-isotopes of an element where these have long or approximately equal half-lives. Sli counter and photographic plate techniques for analysi of deposits are described. An example, the analysis o a rare earth mixture, is described. A.

539.155.2 : 541.2

670. The natural abundance of isotopes of stable elements. WHITE, J. R. AND CAMERON, A. E. *Phys Rev.*, **74**, 991–1000 (*Nov.* 1, 1948).—The natura

isotopic abundances of the following elements have been determined by mass spectrometric techniques: Li, Mg, Si, R, Ca, Cr, Fe, Ni, Cu, Se, Br, Sr, Zr, Ag, Cd, In, Sn, Sb, Te, Ta, W, Re, Tl, Pb. Different masses were focused by variation of the magnetic flux in Nier-type, 60° mass spectrometers. Ion currents were measured potentiometrically. Each measurement represents at least 15 determinations. Many measurements are averages of series with different spectrometers and ion sources. From available packing fraction data and these abundances the chemical atomic weights have been computed. A.

RADIOACTIVITY . α-, β- AND γ-RAYS 539.16

539.16

671. Radioactivity and mineral composition of soil. HOOGTEIJLING, P. J. AND SIZOO, G. J. *Physica, 's Grav.*, **14**, 357–66 (*Aug.*, 1948) *In English.*

539.16.08

672. A novel expansion ratio control for Wilson cloud chambers. HELMER, A. M. C. Note in *Rev. Sci. Instrum.*, **19**, 723 (*Oct.*, 1948).

539.16.08

673. Erratum: Alkali halide scintillation counters. HOFSTADTER, R. Letter in *Phys. Rev.*, **74**, 628 (*Sept.* 1, 1948).—Abstr. 3879 (1948).

539.16.08 : 531.791 : 621.318.572

674. A new quenching circuit for Geiger counters. MAIER-LEIBNITZ, H. *Rev. Sci. Instrum.*, **19**, 500–2 (*Aug.*, 1948).—Abstr. 136 B (1949).

539.16.08 : 539.155.2 : 537.56

675. Routine use of ionization chamber method for C^{14} assay. JANNEY, C. D. AND MOYER, B. J. *Rev. Sci. Instrum.*, **19**, 667–74 (*Oct.*, 1948).—The design and routine use of apparatus for the measurement of amounts of C^{14} down to a specific activity of the order of 10^{-9} curie/g is described. Use is made of an ionization chamber containing the sample to be analysed (as CO_2) and a Lindemann electrometer. The auxiliary electrometer circuits and the apparatus for handling the CO_2 gas are also presented. The method is used for the routine analysis of samples from biological tracer experiments. A comparison with other methods of C^{14} detection is included. A.

539.16.08 : 621.318.572

676. Coincidence-counting system of high resolution. SCHULTZ, H. L. AND BERINGER, R. *Rev. Sci. Instrum.*, **19**, 424–7 (*July*, 1948).—Abstr. 468 B (1949).

539.16.08 : 621.318.572

677. Circuit for testing efficiency of Geiger counters. HAGEN, G. E. AND LOUGHRIDGE, D. H. *Rev. Sci. Instrum.*, **19**, 526–8 (*Aug.*, 1948).—Abstr. 135 B (1949).

539.16.08 : 621.318.572

678. Coincidence circuit of medium resolution. SCHULTZ, H. L. AND POLLARD, E. *Rev. Sci. Instrum.*, **19**, 617–20 (*Oct.*, 1948).—Abstr. 469 B (1948).

539.162 : 539.155.2

679. On the energy-period relation of α-emitting radio-elements. BERTHELOT, A. *C.R. Acad. Sci., Paris*, **227**, 829–31 (*Oct.* 27, 1948) *In French.*—A grouping of α-active nuclei by isotopes rather than by radioactive families is presented. For a given value of Z, E *v.* $\log T$ for the various isotopes is shown to fit fairly well the curve calculated from the Gamow theory. A. P. F.

539.163.1

680. On the half-life of K^{40}. GRÁF, T. Letter in *Phys. Rev.*, **74**, 831 (*Oct.* 1, 1948).—Neglect of back-scattering invalidates the value of $(7 \pm 1) \times 10^8$ yr obtained for the β $\frac{1}{2}$-life of K^{40} by Bleuler and Gabriel [Abstr. 1606 (1947)]. A new determination, comparing the β-radiations of K^{40} and UX_2, with precautions to eliminate back-scattering, gave the rate of emission of β-particles as $26{\cdot}8 \pm 1{\cdot}2$/sec/gr of K, giving a β-decay period for K^{40} of $(13{\cdot}7 \pm 1{\cdot}5) \times 10^8$ yr. The ratio γ/β is $0{\cdot}127 \pm 0{\cdot}012$. The corrected branching ratio $[(K \text{ or } \beta^+)/\beta]$ is $1{\cdot}8 \pm 0{\cdot}5$, and the total $\frac{1}{2}$-life $(5 \pm 1{\cdot}5) \times 10^8$ yr. A. O. S.

539.163.2

681. Fluctuations of ionization and low-energy beta-spectra. KIRKWOOD, D. H. W., PONTECORVO, B. AND HANNA, G. C. Letter in *Phys. Rev.*, **74**, 497–8 (*Aug.* 15, 1948).—The pulses produced by A^{37} in an $A\text{–}CH_4$ proportional counter have been studied using a linear amplifier and 30-channel pulse analyser. Two peaks were observed at 2·8 keV (the binding energy of an electron in the K-shell of Cl^{37}) and 0·2 keV (binding energy for the L-shell). The low energy peak is attributed either to a possible L-capture process, or to a K-capture in which the 2·6 keV K_α radiation emitted by the Cl^{37} atom is not absorbed in the counter. The width of the high energy peak observed was definitely $<$ expected on the basis of a Poisson distribution [Abstr. 2583 (1947)]. Tests were also carried out with Cu K_α X-rays which were allowed to fall on the counter. R. W. P.

539.163.2

682. Erratum: A rapid method for the determination of the maximum energies of β-emitters with simple spectra. YAFFE, L. AND JUSTUS, K. M. Letter in *Phys. Rev.*, **74**, 850 (*Oct.* 1, 1948).—Abstr. 3889 (1948).

539.163.2

683. Alpha-ray spectra of RaC and RaC′. CHANG, W. Y. Letter in *Phys. Rev.*, **74**, 1195–6 (*Nov.* 1, 1948).—Using the method previously described [Abstr. 1682 (1946), 964 (1947)], lines were found at 5·517, 5·466 and 5·333 MeV (RaC) and 9·080 MeV (RaC′) referred to the line at 7·683 MeV (RaC′) taken as the standard. The errors were all ±0·02 MeV. The intensities were 160, 200, 70 and 30 respectively, referred to 10^6 for the line at 7·683 MeV. B. R.

539.163.2

684. Alpha-ray spectra of RdTh, ThC and ThC′. CHANG, W. Y. AND COOR, T. Letter in *Phys. Rev.*, **74**, 1196–7 (*Nov.* 1, 1948).—Using the method previously described [Abstr. 1682 (1946), 964 (1947)] lines were found at $5{\cdot}354 \pm 0{\cdot}02$ MeV (RdTh), $6{\cdot}113 \pm 0{\cdot}02$ and $6{\cdot}074 \pm 0{\cdot}02$ MeV (ThC) referred to the line at 5·420 MeV (RdTh) as a standard. Also at $10{\cdot}553 \pm 0{\cdot}01$ MeV (ThC′) referred to the line at 8·778 MeV (ThC′) as a standard. The relative intensities were respectively 8, 9, 30, 30, 250

and 10^6. Lines at 7·663 and 6·891 MeV are ascribed to contamination. B. R.

539.163.2/.4

685. On the preparation and radiation of U^{237}. MELANDER, L. AND SLÄTIS, H. *Ark. Mat. Astr. Fys.*, **36 A,** *Paper* 15, 9 *pp.* (1948) *In English.*—U^{237} was extracted by a Szilard–Chalmers method from uranyl salicylaldehyde-ortho-phenylenediimine after bombardment with fast neutrons. The γ-radiation was studied by absorption methods and by observation of internal conversion electrons in a β-ray spectrometer. 3 γ-rays, of 57, 204 and 260 keV, were present. The continuous β-spectrum appeared to have an upper limit of $\sim 0{\cdot}23$ MeV. The $\frac{1}{2}$-life is given as $6{\cdot}63 \pm 0{\cdot}05$ days. A. P. F.

539.164.92 : 536.48

686. Ionization by alpha-particles in liquids at low temperatures. I. Measurements in liquid nitrogen and liquid hydrogen. GERRITSEN, A. N. *Commun. K. Onnes Lab., Leiden* (*No.* 275*a*). *Physica, 's Grav.*, **14,** 381–406 (*Aug.*, 1948) *In English.*—After a review of the theories of Jaffé and Kramers concerning column ionization in liquids at low temperatures a simple method for measuring the ionization currents is described. The results of several series of measurements in liquid N and liquid H are given. It seems probable that in N the linear dependence of the current on the field is, in contradiction to Jaffé's theory, due to the corrective influence of the diffusion on the distribution of the ions in the liquid. Kramers's theory proves to be in qualitative agreement with the results. A.

539.164.92 : 536.48

687. Ionization by alpha-particles in liquids at low temperatures. II. Measurements in liquid helium and liquid argon. GERRITSEN, A. N. *Commun. K. Onnes Lab., Leiden* (*No.* 275*b*). *Physica, 's Grav.*, **14,** 407–24 (*Aug.*, 1948) *In English.*—[See Abstr. 686 (1949)]. Results are reported of ionization measurements with α-particles of Po in liquid He and liquid A. In both cases the results cannot be described by the formulae of Kramers's theory, as could the cases of N and H. This may be due to the inadequacy of Jaffé's assumption of an initial Gaussian distribution of the densities of the ions along the path of the α-particle; a correction calculated on the assumption of a spreading of the ratio between the local linear ion density and the local diameter of the column leads to a better applicability of the theory. The currents in the liquified inert gases are 10 to 20 times larger than in liquid N and liquid H. This seems to require a value of the recombination of the ions in liquid He and liquid A, which is much smaller than that given by Langevin's classical expression. Apart from an irregularity in the immediate neighbourhood of the λ-point, the currents in liquid He are nearly the same above and below the transition temperature. The results with α-particles are similar to those with X-rays as an ionizer. A.

539.165.2

688. β-disintegration and the Sargent diagram. FEATHER, N. AND RICHARDSON, H. O. W. *Proc. Phys. Soc., Lond.*, **61,** 452–65 (*Nov.*, 1948).—Sargent diagrams constructed for β-active species having $80 < Z < 94$ (as also for the restricted group with $80 < Z < 84$), and for both β-active and positron-active species having $Z < 22$, are discussed in the light of theory. The majority of first-forbidden transitions in the group of heaviest radioelements give a Sargent line parallel to the allowed line, corresponding to disintegration constants smaller by a factor of roughly 10 only than the disintegration constants of allowed transitions of equal energy. Transitions with no parity change between states of zero spin appear to give a second-forbidden line also parallel to the allowed line. With the lightest radioelements "super-allowed" transitions are identified which require Wigner selection rules for their interpretation, but there is also a group of transitions which appears to be ordinarily allowed (i.e. subject to spin and parity selection rules only). Compared with these allowed transitions in the lightest elements, allowed transitions in the heaviest radioelements are less probable by a factor of about three only, when comparison is made for equal energy release and account is taken of the effect of the Coulomb field of the nucleus. On the assumption that all $\binom{\text{even}}{\text{even}}$ nuclei have even parity and zero spin in the ground state it is concluded that the β-particles of maximum energy observed with RaB, RaC and $MsTh_1$, are emitted in transitions to excited states of the final nuclei as RaC, RaC′ and $MsTh_2$ respectively. This conclusion makes it likely that the accepted value of the total γ-ray emission from RaB [Abstr. 2025 (1937)] is too small, that the total disintegration energy RaC.C′ is 3·78 MeV and that $MsTh_1$ emits a low-energy γ-radiation which has not as yet been detected. On the same assumption it is concluded that the disintegrations $UX_1.UX_2$ and $UX_2.U_{II}$ possess features at present unknown or insufficiently understood. A.

539.165.2 : 539.16.08

689. Investigations using a permanent-magnet double β-ray spectrograph with coincidence counting. I. Experiments with thorium active deposit. FEATHER, N., KYLES, J. AND PRINGLE, R. W. *Proc. Phys. Soc. Lond.*, **61,** 466–78 (*Nov.*, 1948).—A detailed description is given of a semicircular focusing β-particle spectrograph in which a thin source is centrally placed and sheaves of oppositely moving electrons are investigated using two thin-windowed Geiger counters. These counters can be used in a coincidence arrangement, and each is capable of movement so as to accept electrons which have been focused with any radius of curvature between 2·5 cm and 6 cm. The arrangement was tested using sources of thorium active deposit. During this work the (coincidence) β-particle spectrum for the ThB.C transition leading to the 238 keV state of ThC was obtained separately for the first time and its end-point determined as 355 keV. A feeble higher-energy β-component due to ThB was also detected and the end-point estimated at 589 keV. Redeterminations of the end-points of the β-particle spectra of ThC and ThC″ (by β–γ coincidences) gave values of 2·256 MeV and 1·805 MeV, respectively. The intensity of the *F*-line of ThB was found to be 0·288 photoelectrons per disintegration. A.

539.166.2 : 539.167.

690. A search for gamma-rays from He^6 and F^{18}. KNOX, W. J. Letter in *Phys. Rev.*, **74,** 1192–3 (*Nov.* 1948).—The ratios of positrons to photons for source

of F^{18} and C^{11}, measured by absorption methods, were equal. With the assumption that the γ-radiation from C^{11} is pure annihilation radiation, there is thus no evidence for nuclear γ-radiation from F^{18}. The $\frac{1}{2}$-life of He^6 was found to be $0{\cdot}82 \pm 0{\cdot}06$ sec, and the β end-point to be $3{\cdot}7 \pm 0{\cdot}2$ MeV by absorption methods, in agreement with previous work [Abstr. 1359 (1946)]. The radiation penetrating more than 2 g/cm² of absorber is ascribed to bremsstrahlung. Any nuclear γ-radiation must be either <100 keV in energy or of low intensity. B. R.

539.167.3

691. Simultaneous emission of two electrons in the radioactive decay of rubidium 87. HAXEL, O. AND HOUTERMANS, F. G. *Z. Phys.*, **124** (*Nos* 7–12) 705–13 (1948) *In German.*—A layer of RbCl was deposited on a thin foil forming the dividing wall between two Geiger counters. Single and coincidence counting rates were observed as functions of the source thickness. From the results it was inferred that in each disintegration 2 electrons are emitted, one with very feeble energy, with no directional correlation. It is suggested that one electron (possibly the more energetic of the pair) comes from 100% conversion of a γ-ray. The $\frac{1}{2}$-life of Rb^{87} is given as $6{\cdot}9 \times 10^{10}$ y. A. P. F.

NUCLEAR REACTIONS 539.17

539.17 : 521.042 : 523.12

The origin of elements and the separation of galaxies. *See Abstr.* 407

539.17 : 523.877

Thermo-nuclear reactions at high densities. (Degenerate and non-degenerate gas). *See Abstr.* 431

539.17 : 537.534

692. Deuteron-induced reactions. PEASLEE, D. C. *Phys. Rev.*, **74**, 1001–13 (*Nov.* 1, 1948).—A simple semi-classical model is described for the computation of *d–p* and *d–n* cross-sections. It is found that the stripping process is responsible for practically the entire observed *d–p* cross-section at any bombarding energy E_d. The few available quantitative *d–p* measurements—for Na^{23}, Co^{59}, Cu^{63}, Br^{81} and Bi^{209}—agree with curves calculated by assuming that only the stripping process is effective. As E_d increases above the barrier height of the target nucleus, the measured *d–p* cross-sections diminish; this is interpreted as due to effective *d–n* competition, in which the excited nucleus re-emits a neutron after acquiring one in the *d–p* stripping process. It is expected that the *d–n* excitation curves are also predominantly due to the stripping process for incident energies $E_d \geqslant 10$ MeV. To compare observed magnitudes with the calculated values, it is necessary to specify as a nuclear parameter the average "sticking probability" ξ of an elementary particle. Comparison of the *d–p* and *d–n* stripping processes indicates that for a given target the ratio σ_{dp}/σ_{dn} will exceed unity at all energies E_d comparable with the Coulomb barrier and may approach the limit $\sigma_{dp}/\sigma_{dn} \to \xi_n/\xi_p \simeq 1$ as $E_d \to \infty$. A.

539.172.11

693. Contributions to the nuclear processes induced in magnesium by polonium alpha-particles. SZALAY, A. AND CSONGOR, E. *Phys. Rev.*, **74**, 1063–70 (*Nov.* 1, 1948).—Mg metal was bombarded in hemispherical symmetrical arrangements from the centre by a strong Po source. The excitation function of the induced Al^{28} activity and of the induced γ-radiation was determined with an improved resolving power and accuracy. The absolute yields were determined carefully. Possibilities for the origin of the γ-radiation are discussed. A.

539.172.4 : 539.185

694. Technique for observing nuclear disintegrations and scattering in small gas volumes. TASCHEK, R. F. *Rev. Sci. Instrum.*, **19**, 591–4 (*Sept.*, 1948).—A scattering chamber of small gas volume is described and its uses as a neutron source pointed out. Data are shown for the deuteron-deuteron interaction. A.

ATOM AND MOLECULE BEAMS . MESONS NEUTRONS 539.18

539.18

695. On the theory of the resonance scattering of particles. AKHIESER, A. AND POMERANCHUK, I. *J. Exp. Theor. Phys., USSR*, **18**, 603–8 (*July*, 1948) *In Russian.*—A simple method of treating the problem for slow particles. It is shown that only two general types of scattering of slow particles by nuclei are possible, viz. scattering with an amplitude equal to the superposed amplitudes of resonance and potential scattering, and scattering of the type of slow neutron scattering by protons. The radius of action of the nuclear forces is derived on this method in an entirely natural way, without any special assumptions. A.

539.18

696. Erratum: An example of the beta-decay of the light meson. FOWLER, E. C. Letter in *Phys. Rev.*, **74**, 850 (*Oct.* 1, 1948).—Abstr. 3945 (1948).

539.18 : 537.133

697. Masses of mesons. FÜRTH, R. Letter in *Nature, Lond.*, **162**, 772–3 (*Nov.* 13, 1948).—Assuming the author's principle of "elementary indeterminacy" the mass ratio of a proton and a π-meson is $m_p/m_\pi = 2\pi$ giving $m_\pi = 293$. It is also suggested that the π–μ decay is the analogue of the Compton effect, the π-meson colliding with a nucleon. This gives $m_\pi/m_\mu = 1 + (1/\pi) = 1{\cdot}32$. This scattering process can be continued with μ-mesons giving mesons of even smaller mass. G. J. K.

539.18 : 537.591

698. Multiplication of fast particles in the gas of a cloud chamber. DAUDIN, J. *C.R. Acad. Sci., Paris*, **226**, 484–6 (*Feb.* 9, 1948) *In French.*—Photographs without magnetic field [Abstr. 1565 (1947) and earlier work] are re-examined in the light of the abnormal scattering in the gas of a cloud chamber and the production of non-electronic pairs [Abstr. 1071 (1948)]. Attention is directed to examples which may be of the same nature. J. G. W.

539.181.08

699. Measurement of density and mean molecular velocity in an atomic beam. PAUL, W. AND WESSEL, G. *Z. Phys.*, **124** (*Nos* 7–12) 691–9 (1948) *In German.*—Using a very sensitive balance, the impulsive force on a small collector and the mass of material condensed upon it were measured at various points over the cross-section of a beam of Ag atoms. The values of mean velocity deduced from the observations agreed very closely with those calculated from the measured oven temperatures. A. P. F.

539.185

700. The number of "fast" neutrons emitted from a (Ra-α + Be) source. HOUTERMANS, F. G. AND TEUCHER, M. *Z. Phys.*, **124** (*Nos* 7–12) 700–4 (1948) *In German.*—Using an ionization chamber lined with U_3O_8, connected to a linear amplifier of ~1 μsec resolving time, the no. of neutrons above the fission threshold energy of U^{238} was found to be 3 800 ± 1 000 per sec per mC, i.e. ~50% of all neutrons emitted. A. P. F.

539.185

701. A quantitative determination of the magnetic moment of the neutron in units of the proton moment. BLOCH, F., NICODEMUS, D. AND STAUB, H. H. *Phys. Rev.*, **74**, 1025–45 (*Nov.* 1, 1948).—A precision determination was made by determining the Larmor precession frequencies of neutrons and protons simultaneously in the same extremely homogeneous magnetic field. The ratio of the two Larmor frequencies gives directly the ratio of the two magnetic moments. The precession frequency of the neutrons is obtained by the occurrence of non-adiabatic transitions of a polarized neutron beam, that of the protons by nuclear induction. Measurements are made so that only small differences in frequency have to be measured in terms of a constant but otherwise unknown standard. The value of the ratio of the two moments is found to be $|\mu_N|/\mu_P = 0{\cdot}685001 \pm 0{\cdot}00003$. By use of this value in connection with the recent determination of the ratio of the moments of proton and deuteron, the deviation of the deuteron moment from additivity is found to be $0{\cdot}02230 \pm 0{\cdot}00009$ nuclear magnetons. A.

539.185 : 523.877

Solution of Milne's problem by the variational method applied to an exponential expansion of the source function. *See Abstr.* 432

539.185 : 537.1: 530.145

702. On the interaction of neutrons with electrons. HOLMBERG, B. *Ark. Mat. Astr. Fys.*, **36 A**, *Paper* 6, 15 *pp.* (1948) *In English.*—The anomalous interaction is calculated for an intermediate charged pseudoscalar meson field, using a cut-off only for the r^{-3} term in the potential. For meson mass 200 or 350 and a coupling constant $f^2/\hbar c \sim 0{\cdot}1, 0{\cdot}2$ it is 40 times the experimentally determined value. If the non-symmetrical neutral scalar-charged pseudoscalar theory is used, the pseudoscalar coupling is weak, and because the neutral mesons make no contribution to the *n–p* interaction agreement can be obtained to within a factor 3. G. J. K.

539.185 : 537.133

703. The theory of scattering of slow neutrons by free protons. HÜCKEL, E. *Z. Naturforsch.*, **3a**, 134–42 (*March*, 1948) *In German.*—Using an e ponential well potential of the form $-Ce^{-r/a}$, wi $a = 2{\cdot}18 \times 10^{-13}$ cm, $C = 32{\cdot}1$ MeV for triplet stat $C = 10{\cdot}2$ MeV for singlet state, good agreement obtained with the experimental scattering cross-sectio from 35 keV to 2 MeV neutron energy. Calculatio are also made for a square well potential and lead t a formula [Abstr. 2013 (1948)] different from th normally used. [But see Abstr. 3600 (1948)]. A. P.

539.185 : 537.13

704. The theory of scattering of slow neutrons b free protons. (Corrections). HÜCKEL, E. *Z. Natu forsch.*, **3a**, 308–9 (*May*, 1948) *In German.*—S Abstr. 703 (1949). A correction to the formula f scattering cross-section in the triplet state brings abo agreement with Bethe's formula. The differen between the singlet state energies as given by Bet and by the author is shown to arise from a differen of definition of that state, and does not affect th calculated values of cross-sections. A. P.

539.185 : 537.534.74 : 530.145

705. On the scattering of fast neutrons by non-centr interaction. HOLMBERG, B. *Univ. Lund., Diss.*, 31 *p* (1948) *In English.*—An analysis of *n–p* scattering given using ordinary methods and also using th *S*-matrix formalism; the two give identical resul and the correspondence between them is demo strated. For small phases expressions are derive corresponding to Born's approximation in the simp case of a central interaction. To calculate larg phases numerical integration was used for the tripl state. Cross-sections are obtained for the Hulth mixed scalar-pseudoscalar non-symmetrical theory 11·2 and 17·4 MeV for two choices of the pseud scalar coupling constant. For one choice the tot cross-section agrees well with experiment, but there strong forward scattering, and the quadrupo moment is incorrect. G. J.

539.185 : 537.534.74 : 539.152

706. Fast neutron-proton scattering and the law interaction between nucleons. BURHOP, E. H. S. AN YADAV, H. N. Letter in *Nature, Lond.*, **162**, 738 (*Nov.* 6, 1948).—Total scattering cross-sections ha been calculated, using the Born approximation 100 MeV and 250 MeV, for potentials of the spheric well, exponential, Gaussian and Yukawa types, wi various ranges, and exchange factors of the form giv by (I) symmetrical, (II) charged and (III) neutr meson theory. The singlet and triplet potentia including the tensor force, have the same distanc dependence. The ^1S potential is chosen to give t virtual state energy, and the ^3S potential to give t deuteron binding energy and quadrupole momer As the range increases the total cross-section seems pass through a minimum and even the least valu only approach the low experimental value for $1{\cdot}18 \times 10^{-13}$ cm range Yukawa potential of type The experimental value of σ_{180}/σ_{90} rules out type potentials and demands a fairly short range in all case The Born approximation is believed to be seriously error only for the spherical well. G. J.

539.185.7 : 539.2

707. Some diffusion problems. BOTHE, W. *Z. Phy* **118** (*Nos* 7–8) 401–8 (1941) *In German.*—The rig

form of the diffusion equation in absorbing media is derived, and rigid expressions for the diffusion constant, diffusion length, direction distribution and albedo are given. H. L.

STRUCTURE OF SOLIDS 539.2

539.215.4 : 537.533.72

708. An electron microscope study of gold smoke deposits. HARRIS, L., JEFFRIES, D. AND SIEGEL, B. M. *J. Appl. Phys.*, **19**, 792–4 (*Aug.*, 1948).—Gold smoke deposits have been examined at high resolution with the electron microscope, and the size and distribution of the unit particles determined. The smokes were produced by evaporating gold from a hot tungsten filament in a partial atmosphere of nitrogen, and the samples were collected on thin collodion films. It was found that the size of the unit colloidal gold particles varied with the pressure of the atmosphere and the rate of evaporation. The manner of aggregation of the particles was found to be independent of the nitrogen atmosphere pressure and rate of evaporation over a relatively wide range. The aggregations, however, changed markedly when a small amount of oxygen was present during the evaporation. Measurements in the visible and infrared regions of the spectrum were correlated with the electron microscope investigations, and it was found that the optical properties of the deposits depend strikingly upon the manner in which the smoke particles aggregate and how the aggregates are distributed. A.

539.219 : 531.73 : 666.3.022

709. Contraction accompanying the dessication of ceramic pastes; apparatus for the registration of the Bigot curve. JOUMIER, E. AND PERRIER, J. *C.R. Acad. Sci., Paris*, **227**, 839–41 (*Oct.* 27, 1948) *In French.*—Details are given of an apparatus which plots automatically the curve of Bigot, i.e. the curve of loss in weight of a sample of material (prism-shaped) against its contraction in length [Bigot, *C.R. Acad. Sci., Paris*, **172**, 755 (1921)]. The pen is lifted from the paper at regular intervals, thus registering time. The apparatus has been used for measuring the contraction of various ceramic pastes on drying; it could be applied to the study of the change in mass as a function of change in volume in diverse reactions, e.g. the adsorption of a gas by a porous solid. S. J. G.

539.219.2 : 620.191.33

710. An observation of corrosion cracking without stress. ROBERTSON, W. D. AND UHLIG, H. H. *J. Appl. Phys.*, **19**, 864–5 (*Sept.*, 1948).—See Abstr. 268 B (1948).

539.23

711. Surface condition and the true physico-chemical properties of metals. CHAUDRON, G. *Rev. Metall.*, **45**, 61–7 (*March–April*, 1948) *In French.*—A discussion of the various surface properties affecting rate of corrosion. The effects of mechanical and electrolytic polishing of metal surfaces are compared; and the observation of the progressive oxidation of Al by determining the change in dissolution potential when the specimen is immersed in an electrolyte is described. The method has been used to study the oxidation of clean Al in wet and dry air and in water. The appearance of isolated points of corrosion, surrounded by circular zones, alternately anodic and cathodic, on Al immersed in water or NaCl solution has been observed micrographically. The dependence of rate of oxidation upon the crystalline texture of the surface is considered. M. R. H.

539.23

712. The production of thin Be foils. BRADNER, H. *Rev. Sci. Instrum.*, **19**, 662–4 (*Oct.*, 1948).—A procedure for making Be foils between 10^{-5} and 10^{-3} cm thick, and with diameters up to $1\frac{1}{2}$ in, is described, and methods of mounting these foils are indicated. A.

539.261 : 548.735.6

713. A new method for the determination of preferred orientations. CUSTERS, J. F. H. *Physica, 's Grav.*, **14**, 453–60 (*Sept.*, 1948) *In English.*—A new method is indicated for the determination of preferred orientations of flat specimens. It is shown that this method implies a somewhat easier construction of pole figures. Moreover, it will simplify appreciably the calculation of the absorption in the specimen in its different positions during the taking of a series of X-ray pictures. A.

539.261 : 548.734.8

714. The intensity distribution along the Debye halo of a flat specimen in connection with a new method for the determination of preferred orientations. CUSTERS, J. F. H. *Physica, 's Grav.*, **14**, 461–74 (*Sept.*, 1948) *In English.*—In the preceding abstract a new method for the determination of preferred orientations had been introduced. In this paper the formulae for the intensity distribution along the Debye halo are communicated when assuming a specimen with random orientation of crystallites. The same formulae may be used to correct for the strongly varying absorption along the Debye halo when preferred orientations have to be determined quantitatively. Moreover, an expression is given for the breadth of the Debye circle which may vary strongly with the azimuth angle. A.

539.27 : 537.533.72

715. Resolution and polygonal-sided objects in the electron microscope. SEELIGER, R. *Optik*, **3** (*No.* 4) 315–19 (1948) *In German.*—Considers the conditions necessary for the recognition of a polygonal-sided object in the electron microscope. The length of side is expressed in terms of the resolution of the electron microscope for polygons with various numbers of sides. J. T.

539.27 : 539.211 : 621.385.833

716. Some observations on the Formvar replica method, with a note on glass surfaces. DEACON, B. M., ELLIS, S. G., CROSS, W. G. AND SENNETT, R. S. *J. Appl. Phys.*, **19**, 704–12 (*Aug.*, 1948).—Abstr. 170 B (1949).

539.27 : 539.4.016

717. Change of metal structure due to cold working. KRANERT, W. AND RAETHER, H. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 6–7) 520–37 (1943) *In German.*—The structural alteration of a metal crystal (Cu, Au) due to cold working (polishing, pressing, rolling) was deduced from electron interference photographs.

After cold working of a large Cu crystal, the surface consisted of a superfine crystalline (quasi-liquid) structure, gradually changing into a normal crystalline powder, and finally reaching the undisturbed parent crystal at a depth of several μ. A thin single crystal when cold-worked changed its structure from crystalline to powder and finally to quasi-liquid or superfine crystal. In certain cases (Cu, Fe, Ni) a superfine crystalline layer of oxide covers a surface which has been cold-worked. V. W. R.

ELASTICITY . STRENGTH . RHEOLOGY
539.3/.8

539.31/.32

718. Measurement of the elastic constants and internal friction of wood. BARDUCCI, I. AND PASQUALINI, G. *Nuovo Cim.*, **5**, 416–46 (*Oct.*, 1948) *In Italian.*—Elastic parameters and internal friction have been determined on strips of wood by a dynamical method, involving the measurement of the resonance frequency and the Q of a vibrating reed. The experimental results lead to the following conclusions: (*a*) the sound velocity c and the Q are strongly dependent on the direction of the sample, yet, as a first approximation, their ratio c/Q is not a directional parameter. Moreover, c/Q is independent of frequency; (*b*) as a first approximation, the angle between direction of elastic waves and direction of fibres is sufficient to determine the direction of the sample; (*c*) the conifers show interesting regularities in their elastic and dissipative properties; (*d*) the elastic parameters and the Q of very old woods seem to be highly modified by an ageing process. The mean values of some elastic and dissipative parameters for 85 different woods are tabulated. A.

539.313

719. The isotropic law of elasticity. RICHTER, H. *Z. angew. Math. Mech.*, **28**, 205–9 (*July–Aug.*, 1948) *In German.*—The conditions of isotropy and of the existence of thermodynamic potentials lead to a general form of the 3-dimensional law of elasticity. This is obtained from the logarithmic strain matrix permitting of a separation of the change of volume from the deformation by forming the ordinary deviator. The elastic energy represents the exact sum of energy of volume change and of deformation only if the mean stress is a function of the change of volume alone. For finite deformations Hooke's law applies only when the Poisson's ratio $m = 3$. A.

539.32 : 538.662.13 : 669.018

720. On the behaviour of the elastic moduli of ordered alloys near the Curie point. KHOLODENKO, L. *J. Exp. Theor. Phys., USSR*, **18**, 812–17 (*Sept.*, 1948) *In Russian.*—The behaviour of the elastic moduli near the Curie point is considered on the basis of Landau's theory of 2nd-order phase transitions. The discontinuities of the elastic moduli are shown to be very small. A relation between the discontinuities of the temperature gradients of the elastic moduli and the discontinuities of the temperature gradients of the coefficients of thermal deformation and heat capacity was derived. This formula is considered in its application to β-brass. A

539.32.08 : 534.321.9 : 548.

Elastic constants of alum determined by a new ultrasonic method. *See Abstr.* 764

539.32.082 : 534.1

721. Methods for measuring dynamic mechanical properties of rubber-like materials. NOLLE, A. W. *J. Appl. Phys.*, **19**, 753–74 (*Aug.*, 1948).—Five methods are described for measuring the complex differential dynamic Young's modulus of rubber-like materials under conditions of very small sinusoidal strain variations, at frequencies from 10^{-1} to 10^5 c/s and in a temperature range which at its widest limits extends from −60 to +100°c. These methods are (1) measurement of the frequency of oscillation and the decrement of a "rocking-beam oscillator" in which the restoring force is supplied by rubber (0·1 to 25 c/s); (2) measurement of the frequency of resonance and the bandwidth of a rubber reed which executes forced oscillation (10 to 500 c/s); (3) measurement of the phase velocity and the attenuation of longitudinal waves in a thin rubber strip in the absence of standing waves (1 to 40 kc/s); (4) measurement of the frequency of longitudinal-wave resonance and the bandwidth of a half-wave transmission line (< 300 c/s); (5) measurement of the change in the frequency of resonance and the change in the bandwidth of a magnetostrictive rod against whose end a rubber sample is pressed (12 to 120 kc/s). Equations are developed for calculating the complex modulus from the results of each experiment, and the practical advantages and limitations of the methods are described. A

539.37

722. Conditions of the occurrence of plastic deformation in solids of simplest shape quenched from the surface. FINKELSTEIN, B. N. *J. Tech. Phys. USSR*, **18**, 1026–8 (*Aug.*, 1948) *In Russian.*

539.374 : 539.38

723. General solution of the problem of plane plasticity for any isotropic or anistropic law of flow. NEUBER, H. *Z. angew. Math. Mech.*, **28**, 253–(*Sept.*, 1948) *In German.*—The solutions of classical theory are only valid for isotropic materials when Mohr's limiting curve is a straight line. By means of a "surface of plasticity" (i.e. 3-dimensional representation of the plane plastic flow in a co-ordinate system formed by the 3 stress components) the general solution of any law of plastic flow may be given by a simple graphical method. The characteristic curves of the equations of equilibrium are the curves of 45° gradient on the surface of plasticity. A

539.374 : 541.6

724. Viscoelastic properties of polymer solutions. FERRY, J. D. *J. Res. Nat. Bur. Stand., Wash.*, **41**, 53–62 (*July*, 1948).—In a concentrated polymer solution the entanglement of long-chain molecules results in a transient network structure, to which may be attributed certain aspects of the viscoelastic behaviour of such a system. A suitable mechanical model for representing this network as a first approximation is a retarded Maxwell element with one spring and two dashpots. Experimental measurements of mechanic

properties of polymer solutions may be made either by periodic deformation under conditions where inertia forces can be neglected or by propagation of transverse waves. The data are expressed in terms of frequency-dependent parameters from which can be derived the constants of the corresponding mechanical model. A solution of polystyrene in xylene is cited as an example. In this case, analysis in terms of a recent theory of Kuhn suggests that elastic energy may be stored in the network strands by twist against the potential hindering free rotation about bonds in the chains. A.

539.382 : 531.787.9 : 535.55

725. Some results of the dynamic testing of materials. VOLTERRA, E. *Riv. Nuovo Cim.*, **4** (*No.* 1) 1–28 (1948) *In Italian.*—Two methods were used to find stress-strain curves for short duration compression stresses. (*a*) A modified Hopkinson pressure bar with Davies [Abstr. 1444 (1948)] electrical recording. Stress impulses of about 3×10^{-4} sec duration were produced by a rifle bullet and the curve for copper is given. (*b*) Optical strain recording with a rotating drum camera, the stress impulse, $3-9\times10^{-2}$ sec duration, being produced by a ballistic pendulum. Mathematical analysis of test results on a certain plastic indicate the existence of a transient after-effect of about 10^{-2} sec duration. T. S. E. T.

539.389.4 : 530.385 : 538.221

726. The torsional stress-strain curves for ferromagnetic materials. (Magnetomechanical hysteresis loops.) KORNETZKI, M. *Ann. Phys., Lpz.* (*Folge* 6) **2** (*Nos* 5–6) 265–9 (1948) *In German.*—The observed relations between torsional stress and strain for cyclic stresses in a soft nickel tube are similar to those between magnetic induction and field strength. For very small amplitudes Rayleigh's law is followed.

A. E. DE B.

539.4.016

727. On the theory of hardening by plastic deformation. MASING, G. *Z. Phys.*, **124** (*Nos* 7–12) 586–601 (1948) *In German.*—A critical review. Hardening is due to increasing difficulty in the movement of dislocations, not in their production. Taylor's theory of the mutual action of dislocations is insufficient, as it predicts a considerable dependence of the rigidity on the degree of deformation. A modification of Mott's theory of the interaction of dislocations and internal stresses explains the phenomena qualitatively.

A. J. C. W.

539.4.016.2 : 621.9.014.2

728. Theory of formation of metal chips. PIISPANEN, V. *J. Appl. Phys.*, **19**, 876–81 (*Oct.*, 1948).—Values for the shear angles have been deduced. Increase of internal friction and strain hardening have been considered. Equations for the work done in cutting per unit of length and for the cutting force were deduced. A high cutting speed decreases the friction angle τ between the chip and the face of the tool, by which the stresses on the machine tool may be steeply decreased. These stresses are highly dependent on the friction angle τ, since the rake angle α is negative. A new theory of the formation of a discontinuous chip is presented. A.

539.42

729. Delayed fracture of materials under tension, torsion and compression. GURNEY, C. AND BORYSOWSKI, Z. *Proc. Phys. Soc., Lond.*, **61**, 446–52 (*Nov.*, 1948).—Delayed fracture experiments were made in tension, torsion and compression, the times to fracture under a series of constant loads being determined. The materials tested were brass in NH_3 vapour, polymerized methyl methacrylate (p.m.m.) in liquid CCl_4 and glass in air. In all cases delayed fracture is attributed to the gradual spread of cracks caused by the preferential attack by the surrounding medium of the highly stressed material at the ends of the cracks. In tension, fractures were transverse and in torsion they were helical. In the case of brass and glass, subjected to tension and torsion, fracture of the respective materials occurred in not greatly differing times when the materials were subjected to the same maximum nominal principal tensile stresses. P.m.m. withstood higher nominal principal stress in torsion than in tension for equal times to fracture. The p.m.m. results were complicated by the absorption of CCl_4, which was greatly accelerated by tension or torsion stresses. During the time occupied by the tests, absorption was inappreciable when the p.m.m. was stress-free or stressed in compression. In no case did delayed fracture occur in compression.

539.501 : 539.389.3 : 532.13

730. Non-linear relations between viscous stresses and instantaneous rate of deformation as a consequence of slow relaxation. BURGERS, J. M. *Proc. K. Ned. Akad. Wet.*, **51** (*No.* 7) 787–92 (1948) *In English.*—In discusssing Weissenberg's work on the stresses called into play by deformation in visco-elastic materials [Abstr. 1332 (1947)], the author suggests that a tangible picture of what occurs can be obtained if it is borne in mind that, owing to the finite rate at which rearrangement of molecular structure occurs, every elementary volume of a flowing medium bears in its molecular pattern some evidence of its past history. The actual molecular pattern during flow differs from the equilibrium pattern, provided the relaxation time is sufficiently large. J. S. G. T.

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM 541.121/.123

541.121 : 541.486

731. On the complex equilibrium of the molecules Br_2, Cl_2, BrCl, and of the atoms Br and Cl in the temperature interval 298·1°K to 3 000°K. BUTKOW, K. *Rec. Trav. Chim. Pays. Bas*, **67**, 551–62 (*Sept.–Oct.*, 1948) *In French.*—Using the latest data on the atomic weight, such as atomic proportions and thermodynamical constants, the chemical equilibrium between molecules Br_2, Cl_2 and BrCl is calculated. A.

541.123

732. Keto-enol transformation of aceto-acetic ester in the gaseous state. BRIEGLEB, G. AND REBELEIN, H. *Z. Naturforsch.*, **2a**, 562–5 (*Oct.*, 1947) *In German.*—The keto-enol equilibrium of acetoacetic ester and the heats of transformation have been determined for the gaseous state for the temperature range 0°–180°c. The enol content is much greater in the gaseous (52% at 20°) than in the liquid state, and increases with rising temperature (by 14% at 180°). The vapour pressures and heats of evaporation of liquid keto-enol mixtures have been measured, and the metastable vapour compositions in metastable equilibrium with various keto-enol liquids have been determined. H. H. HO.

541.123.3 : 536.764 : 536.775

733. Evaporation equilibrium of mixtures. III. Multicomponent systems with several liquid phases. HAASE, R. *Z. Naturforsch.*, **3a**, 323–8 (*June*, 1948) *In German.*—Multiphase equilibrium of systems with an arbitrary number of components is investigated theoretically. A generalized form of the Clausius–Clapeyron equation for univariant equilibrium is derived and a general method is given for calculating the proportions of reactants in various phases. It is shown that if in an n-component system there are more than one, but less than n, liquid phases in equilibrium with vapour, the boiling point at constant pressure, or the vapour pressure at constant temperature, has a max. or min. when the composition of two phases is the same or when such a reaction between phases is possible that their composition remains unaltered. The application of this rule to simple distillation of multiphase liquid systems is discussed. The case of a ternary system containing two liquid phases and one vapour phase is considered in detail. A. SCH.

REACTION KINETICS 541.124/.128

541.124 : 541.128

734. Reaction of atomic hydrogen with methane and benzene. MUND, W., LORIES, R. AND HUYSKENS, P. *Bull. Acad. Belge Cl. Sci.*, **34** (*Nos* 8–9) 651–60 (1948) *In French.*—A reaction of atomic H with CH_4 and C_6H_6 is indicated by the inhibitory effect of these molecules on the radiochemical reaction $D_2 + H_2 \rightarrow 2HD$. The cyclic regeneration of the two substances is an example of negative catalysis in the gas phase. About $5{\cdot}5\times10^6$ collisions are required for a reaction between H and hydrocarbon to occur at 13°c. C. B. A.

541.124.012.6

735. Kinetics of gas-liquid reactions. VAN KREVELEN, D. W. AND HOFTIJZER, P. J. *Rec. Trav. Chim. Pays. Bas*, **67**, 563–626 (*Sept.–Oct.*, 1948) *In English.* **I. General theory** (563–86).—When a gaseous component is absorbed by a liquid under simultaneous reaction with a component of the liquid, the overall rate of reaction proves to be a dimensionless function of 4 limiting rates: (*a*) the max. rate of diffusion of the gaseous component through the liquid film; (*b*) the max. rate of diffusion of the liquid component through the liquid film; (*c*) the limiting rate of reaction within the liquid film (during diffusion); (*d*) the max. rate of reaction within the main body of the liquid. A graphical representation of the theoretical relationship enables one to predict the overall rates of interphase mass exchange under arbitrary conditions when reaction velocity coefficients and mass transfer coefficients are known. **II. Application of general theory to experimental data** (587–626). A.

541.127 : 541.128

736. The reaction of atomic hydrogen with acetylene. TOLLEFSON, E. L. AND LE ROY, D. J. *J. Chem. Phys.*, **16**, 1057–62 (*Nov.*, 1948).—The thermal dissociation of H on hot W filaments has been used in the investigation of the reaction of atomic H with acetylene. A quantitative method has been developed for the detection of atomic H at pressures of the order of 10^{-3} mm. The catalytic effect of acetylene on the recombination of atomic H has been studied and the rate constant of the rate-determining step calculated to be $8{\cdot}6\times10^{-14}$ molecules^{-1} cm^3 sec^{-1} at 25°c. In contrast with results obtained by the discharge tube method, small amounts of hydrogenated products are formed. A.

541.127.3 : 541.123.012.5

737. Temperature lag and chemical kinetics. HORTON, W. S. *J. Phys. Coll. Chem.*, **52**, 1129–36 (*Oct.*, 1948).—A method of computing the concentration of reactant to be expected during a kinetic experiment where thermal equilibrium is not instantly attained. This is done for the two extremes of mixing, with the view that any actual case lies between these limits. In view of the results, suggestions are offered for reducing the errors in specific velocity constants determined in such experiments. A.

ELECTROCHEMISTRY 541.13

541.133.08 : 621.317.733

738. An improved conductance bridge. FOY, W. L. AND MARTELL, A. E. *Rev. Sci. Instrum.*, **19**, 628–32 (*Oct.*, 1948).—Abstr. 438 B (1949).

541.135.5 : 621.357.8

739. Electrical resistance of the electrolytic polishing cell and the anode surface. EPELBOIM, I. AND CHALIN, C. *C.R. Acad. Sci., Paris*, **227**, 835–6 (*Oct.* 27, 1948) *In French.*—Experimental data, obtained in an attempt to correlate cell resistance with anodic surface area, have shown variations in the current-voltage curves which are due to the condition of the anodic surface, the anodic diffusion layer, the nature of the metal and of the electrolyte, and on whether the electrolyte is stirred or not. H. H. HO.

541.135.88 : 538.639

740. Concerning a presumed magnetic effect in electrolytes. PALUMBO, D. AND RICCOBONO, G. *Ric. Sci.*, **18**, 821–3 (*July*, 1948) *In Italian.*—An experimental check of a statement by Destriau, that if one of two electrodes of the same metal immersed

in an electrolyte consisting of a salt, or salts, of such metal, is exposed to the action of a magnetic field, an e.m.f. is generated between these electrodes. The experiments are described and lead to the conclusion that the resulting e.m.f. of the order of 10^{-3} volts is of purely thermoelectric origin. L. J. G.

PHOTOCHEMISTRY 541.14

541.144 : 536.48

741. Radical reactions with certain nitrogen compounds: the conversion of benzene (toluene, etc.) in other compounds at low temperature. BAUDISCH, O. *Science*, **108**, 443–4 (*Oct.* 22, 1948).—Photochemical reactions with Na nitroprusside in which NO is split off are described. A mixture of Na nitroprusside and Fe carbonyl gives black compounds in daylight. With cupferron a violet-blue compound is formed, and with thiourea a deep-blue S- and N-containing complex is formed. Na nitroprusside and H_2O_2 covered with C_6H_6 and exposed to light even at low temp. (−15°) cause formation of *o*-nitrosophenol. Other low temp. reactions with C_6H_6 in which radicals are formed and the N_2 is given off are described. A. J. M.

COLLOIDS . DISPERSE SYSTEMS 541.18/.182

541.18.05 : 541.14

742. On the alleged atomization of metals in liquids under the influence of ultra-violet light. CENTNERSZWER, M. AND WOLDENBERG, A. *Bull. Int. Acad. Polonaise Sci. Lett. A* (*Nos* 1–3) 50–9 (1939) *In German.*—On illuminating certain metals in contact with water with the light from a mercury lamp colloidal solutions may be formed, probably by the action of ozone. Fe, Pb, Ag and Hg give colloids, but pure Pt does not. R. F. B.

541.182

743. Silicic chemistry. A new branch of colloid science. HAUSER, E. A. *J. Phys. Coll. Chem.*, **52**, 1165–74 (*Oct.*, 1948).—The history of the colloid chemistry of Si is reviewed to prove that this branch of the science of colloids is even older than the term "colloid" itself. The opinion that certain properties of matter, such as the formation of solutions of high viscosity and the ability to form gels, are limited to organic compounds is disproved. Attention is drawn to the similarity of the reactions responsible for the formation of organic and siliceous colloids and a uniform terminology for these reactions is suggested. Examples of Si compounds exhibiting the same properties as organic ones are offered. Various colloidal phenomena characteristic of Si compounds and their importance to science and industry are discussed. Attention is drawn to the versatility of this new field, and the suggestion is made to give it the name "silicic chemistry." A.

ADSORPTION 541.183

541.183

744. Passivity of stainless steel and the phenomenon of adsorption. GUITTON, L. *C.R. Acad. Sci., Paris*, **226**, 805–7 (*March* 8, 1948) *In French.*—The passivity of stainless steels (18% Cr, or 10% M_1 or 10% M_2) can be considerably increased if the passivation proper (e.g. in 10% HNO_3) is preceded by sensitization (e.g. in fluonitric acid). During sensitization H_2 probably penetrates into the non-ferrous metal, displacing its ions and so increasing their affinity for O. S. J. G.

541.183 : 532.615

745. Characteristics of reversibility and irreversibility of the contraction curves of thin films. MATALON, R. *C.R. Acad. Sci., Paris*, **227**, 590–1 (*Sept.* 20, 1948) *In French.*—Foaming solutions were studied by drawing thin films out of the surface with the stirrup described earlier. [See Abstr. 1026 (1947)]. The curves relating force to the height of the top edge of the film above the solution surface throw light on the foaming properties. The factors involved are: (1) the ease with which solute molecules reach the liquid/air interface; (2) the resistance of the film to drying. The curve relating force to height obtained when drawing up the film may or may not be superimposable on the curve obtained when the film is lowered back ("retour") into the solution. It depends on: (*a*) the speed of diffusion of adsorbed molecules to the film surface on raising the film and the speed of removal of molecules from the film surface on lowering the film; (*b*) whether the adsorbed molecules are in a different physical form from those in the body of the solution, e.g. proteins. J. I.

541.183 : 532.615

746. Conditions of formation of foams deduced from the study of the curves of extension and contraction [of thin films]. MATALON, R. *C.R. Acad. Sci., Paris*, **227**, 634–5 (*Sept.* 27, 1948) *In French.*—In an attempt to formulate a more precise definition of the conditions for the formation of foams the following factors are studied. (1) Speed of diffusion of solute molecules to the adsorbed film on the surface of the solution; (2) the physical state and structure of the liquid/air interface during the production of foam. When a thin film is raised from a foaming solution [see Abstr. 1026 (1947)] the tension in the film can change by 6–7 dynes/cm while the film is raised to the point where the film ruptures. This shows a progressive impoverishment in the film surfaces of adsorbed solute molecules. The curves obtained when the film is returned to the solution by lowering the stirrup provide a means of studying the speed of diffusion and the physical state of the adsorbed layer. [See Abstr. 745 (1949)]. J. I.

541.183 : 536.658

747. Heats of adsorption. I. PIERCE, C. AND SMITH, R. N. *J. Phys. Coll. Chem.*, **52**, 1111–15 (*Oct.*, 1948).—Isosteric measurements have been made of the heats of adsorption of ethyl chloride on graphite at temperatures of 0°C and 78°C. It is found that the differential heat of adsorption is much higher than the heat of liquefaction during the adsorption of the first and second layers, that E_A drops to only slightly above the heat of liquefaction when the adsorbed

film becomes several molecules in thickness, and that E_A never becomes equal with E_L within the measurable pressure range.

541.183 : 536.658

748. Heats of adsorption. II. SMITH, R. N. AND PIERCE, C. *J. Phys. Coll. Chem.*, **52**, 1115–28 (*Oct.*, 1948).—Experimental isotherms are given for H_2O, NH_3 and C_2H_5Cl on graphite of nitrogen area 4 sq. m per gram. Isosteric heats of adsorption are computed for NH_3 and C_2H_5Cl. It is shown that for all relative pressures the heat of adsorption exceeds the heat of liquefaction. The heat of adsorption for all layers beyond the first is a linear function of relative pressure: $E - E_L = K(p_0 - p)/p_0$. Certain limitations of the B.E.T. equation are discussed. An isotherm equation, based upon a new interpretation of multilayer adsorption, is proposed. This is applied to 25 isotherms for non-porous substances and fits well in all cases. A.

541.183.3 : 545.84 : 537.226.2

749. Dielectric theory of selective adsorption (chromatography). KAMIEŃSKI, B. *Bull. Int. Acad. Polonaise Sci. Lett. A* (*Nos* 1–3) 1–4 (*Jan.–March*, 1947) *In English.*—The dielectric constant of the adsorbent, the dipole moments of the liquids and the *pH* influence selective adsorption. Adsorption increases with increasing dielectric constant of the adsorbent, and with increasing dipole moment μ of the liquid. The order of adsorption is, therefore, $H_2O > C_2H_5OH > C_6H_6$; and of adsorbing power is titania > alumina. Drying the adsorbent is very important owing to the high μ of H_2O; e.g. alumina dried at 200° gives a good chromatogram with carotenoids, but undried alumina gives none. Strong heating reduces the adsorbing power of the adsorbent. S. J. G.

CHEMICAL STRUCTURE 541.4/.6

541.654 : 535.343.4 : 535.375.56

750. The molecular structure of nitromethane. BOGDAN, Ş. AND ŞTEFĂNESCU, D. *Bull. Soc. Roumaine Phys.*, **42** (*No.* 78) 73–86 (1941) *In German.*

541.67 : 541.64

751. Applications of magnetochemistry to polymers and polymerization. SELWOOD, P. W. *J. Res. Nat. Bur. Stand., Wash.*, **41**, 151–62 (*Aug.*, 1948).—After a brief review of fundamental definitions, experimental methods, theoretical and semi-empirical results on diamagnetic substances, two topics are considered: first, studies of the diamagnetic anisotropy of crystalline and oriented materials. Using solid naphthalene as an illustration, it is shown how to obtain the principal molecular susceptibilities from the measured parameters of the single crystal and the molecular orientations in the unit cell as derived from X-ray studies. Conversely, the direction cosines for solid diphenyl are calculated from the measured macroscopic susceptibilities and the susceptibilities of the molecule. Results recently obtained on the anisotropy of cellulose, protein fibres, and stretched rubber indicate the value of such methods, particularly for oriented polymers containing aromatic groups, because of the large effects of the latter. Next, attention is devoted to the paramagnetism of oxygen and free radicals that can be utilized as a measure of the concentration of the species. Radical concentrations as low as 10^{-6} mole/l may be estimated by means of a modification of the Gouy balance. It has been employed in a study of the thermal polymerization of styrene at 66°c. From the changes in diamagnetism in the course of the reaction, the rate of consumption of oxygen present is determined. Assuming this to be due to combination with styrene radicals, the rate of thermal initiation $\simeq 3{\cdot}8 \times 10^{-1}$ mole^{-1} l sec^{-1}. However, in order to obtain by magnetic methods directly the free radical concentration in ordinary chain polymerization processes, the sensitivity would have to be improved by several orders of magnitude. A

CHEMICAL APPARATUS 542.1/.7

542.48

752. Rectification by heating the liquid phase and cooling the vapour phase. ROLLET, A. P. *C.R. Acad. Sci., Paris*, **227**, 588–9 (*Sept.* 20, 1948) *In French.*—A rectifying column, suitable for the rectification of a mixture of two volatile liquids and consisting of a pyrex tube, 1·4 cm internal diameter, 90 cm long and inclined at 5 degrees to the horizontal, is described. The lower part of the tube is heated electrically and the upper part cooled with a liquid. Figures for tests performed with the mixtures benzene-toluene and benzene-ethylene chloride are given. S. W.

CHEMICAL ANALYSIS 543/545

544.62 : 545.82

753. Spectrochemistry. (The most important spectrochemical publications in Germany of the years 1939–1942). GATTERER, A. *Rel. Pont. Acad. Sci.* (*Auct. Sci. Temp. Belli*) (*No.* 2) 19 *pp.* (1939–45) *In German.*—Bibliography, introduced by short surveys on the individual fields of work (including small selection of foreign papers).

545.3 : 537.361

754. Polarography. Some factors affecting drop time. ENGLISH, F. L. *Analyt. Chem.*, **20**, 889–91 (*Oct.*, 1948).—Data are presented showing the influence of capillary vibration, applied voltage, magnitude of current flowing through the cell, capillary active agents, purity of mercury (including certain amalgams), and stray currents in the constant temperature bath upon the drop time. A

545.37 : 621.318.572

755. Electronic trigger circuit for automatic potentiometric and photometric titrations. MULLER, R. H. AND LINGANE, J. J. *Analyt. Chem.*, **20**, 795–7 (*Sept.* 1948).—Abstr. 137 B (1949).

545.7 : 536.23

756. Determination of water vapor. Thermal conductivity methods. CHERRY, R. H. *Analyt. Chem.* **20**, 958–62 (*Oct.*, 1948).—A saturator capable of delivering a stream of gas containing saturated water vapour in amount constant to ±0·01% by volume

in the temperature range 0·5° to 45°C and at rates up to 1 000 ml/min is described. The limitations, advantages, and unique characteristics of the thermal conductivity method of gas analysis are discussed with particular reference to the quantitative determination of water vapour in gas mixtures. Recording equipment of this type can be made to have excellent constancy of calibration and zero stability. The useful dew point range for water vapour in air, N_2, or O_2 is −18°C to 50°C and from 80°C up. These dew points correspond, respectively, to approximately 0·16, 12·3 and 47·4% water vapour by vol. A.

545.822

757. Contribution to quantitative spectral analysis of solutions in sparks. PAVLOVSCHI, G. AND MAVRODINEANU, R. *Bull. Soc. Roumaine Phys.*, **42** (*No.* 78) 53–61 (1941) *In German.*—A method is described for the chemical analysis of solutions by spark spectra. Small sticks of porous quartz are used as electrodes. These absorb the solution by capillarity and can be cleaned and used indefinitely. One advantage is that the spectrum is not contaminated with bands or continuum from the electrodes. A. G. G.

545.822

758. Determination of olefins in gasoline. Application of infrared spectroscopy. JOHNSTON, R. W. B., APPLEBY, W. G. AND BAKER, M. O. *Analyt. Chem.*, **20,** 805–12 (*Sept.*, 1948).—A method of differentiating alpha-olefins (of the general type $R–CH=CH_2$ or $R_2C=CH_2$) from olefins with internal double bonds (of the general type R–CH=CH–R) is discussed. A.

545.822

759. Infrared analysis of organic mixtures. Using C–H band structure resolved by a lithium fluoride prism. SAIER, E. L. AND COGGESHALL, N. D. *Analyt. Chem.*, **20,** 812–17 (*Sept.*, 1948).—With a prism of NaCl the usual infrared spectrometer does not resolve the structure of the absorption bands due to C–H groups. A LiF prism which possesses high dispersion in this spectral region resolves these bands very satisfactorily and makes them available for analytical determinations. Using such a prism, a number of specific analyses have been developed. This method of analysis allows the examination of compounds and mixtures in dilute solutions of CCl_4 as well as the analysis of compounds subject to complex formation such as H bonding and the analysis of mixtures possessing large differences of intensity of absorption in the NaCl region. It makes possible a new approach to systems of very similar isomers; and it extends the usefulness of instruments equipped with such a prism for molecular structure determination work. A.

545.824 : 548.73

760. Basic aspects of X-ray absorption in quantitative diffraction analysis of powder mixtures. ALEXANDER, L. AND KLUG, H. P. *Analyt. Chem.*, **20,** 886–9 (*Oct.*, 1948).—The mathematical relationships are developed which are pertinent to the quantitative analysis of powder mixtures for the case of diffraction from the surface of a flat powder specimen. These formulae relate the diffracted intensity to the absorptive properties of the sample. Three important cases are treated: (1) Mixture of n components; absorbing power of the unknown = that of the matrix; concentration $\propto$ intensity. Direct analysis is permitted. (2) Binary mixture; absorbing power of the unknown $\neq$ that of the diluent; concentration not $\propto$ intensity. Direct analysis is possible by means of calibration curves prepared from synthetic mixtures. (3) Mixture of n components; absorbing power of the unknown $\neq$ that of the matrix; general case. Analysis is accomplished by the addition of an internal standard. Concentration $\propto$ the ratio of the intensity of a selected reflection from the unknown to the intensity of a reflection from the internal standard. A.

545.827

761. Mass spectra of some organic compounds. ROBERTS, R. H. AND JOHNSEN, S. E. J. *Analyt. Chem.*, **20,** 690–9 (*Aug.*, 1948).—Mass spectra (electronic dissociation patterns) are given for 53 compounds, in terms of ratios of peak readings of different masses. These will not be strictly reproduced with all instruments, but are intended to aid in the analysis of a mixture of organic components. A.

545.827 : 541.6 : 539.13

762. Mass spectra of hydrocarbons. MOHLER, F. L. *J. Wash. Acad. Sci.*, **38,** 193–9 (*June* 15, 1948).—The use of a mass spectrometer for chemical analysis of hydrocarbons is described. With electron bombarding energy, in the spectrometer ion source, in the range 50–100 volts the mass spectrum is nearly independent of this energy and is a property of the molecule, and nearly all possible ionic dissociation products are present. Simplified mass spectra of saturated hydrocarbons from methane to hexane, including the isomers, are given, with a discussion of the effects of rearrangement of atoms in the molecule and the types of ionic dissociation in each case. There is a similar treatment of various unsaturated molecules. Spontaneous dissociation of highly excited molecular ions, formed by electron capture in the ion source, yields the great variety of ions observed; a small proportion come from metastable ions, and show as broad peaks. Results of studies of these metastable transitions are discussed in some detail. The theoretical background of the mass spectra is still unknown; in the absence of this, chemical analysis involves comparison with pure samples of the constituents of the unknown mixture. T. G. P.

CRYSTALLOGRAPHY 548

548.0

763. Crystal structure of Pt_2Sn_3. SCHUBERT, K. AND PFISTERER, H. *Z. Naturforsch.*, **3a,** 128 (*Feb.*, 1948) *In German.*

548.0 : 539.32.08 : 534.321.9

764. Elastic constants of alum determined by a new ultrasonic method. BHAGAVANTAM, S. AND RAMACHANDRA RAO, B. Letter in *Nature, Lond.*, **162,**

818–19 (*Nov.* 20, 1948).—An *X*- or *Y*-cut quartz crystal is cemented on to a highly polished and accurately cut prism of alum and the velocity of sound in the alum is determined by photographing the diffraction patterns at known frequencies in excess of 50 Mc/s. The elastic constants for certain specified directions are quoted. The method can be extended to a study of the dependence of the elastic constants on temperature. H. J. H. S.

548.0 : 539.373 : 539.4.011.22

765. Optical limit of elasticity of sodium chloride crystals for slipping along cubic faces. Stepanov, A. V. and Milkamanovich, E. A. *J. Exp. Theor. Phys., USSR.*, **18**, 769–72 (*Sept.*, 1948) *In Russian.*—Results of the optical determination of the limit of elasticity of NaCl crystals for the case of slipping along the cubic faces (100) and in the direction [110] are presented. The dependence of the limit of elasticity on temperature was determined. A.

548.0 : 548.73

766. Recent advances in the study of the crystalline state. Bragg, W. L. *Science*, **108**, 455–63 (*Oct.* 29, 1948).—A review of British work. A. J. C. W.

548.51 : 532.782 : 541.123.2 : 536.42

767. Nucleation. Fisher, J. C., Hollomon, J. H. and Turnbull, D. *J. Appl. Phys.*, **19**, 775–84 (*Aug.*, 1948).—Based on Turnbull's concept of the importance of transient nucleation during phase transformations in solids, a general theory of nucleation has been developed. The nucleation mechanism for reactions where stable nuclei appear only during cooling or plastic deformation has been clarified. The general theory makes possible quantitative description of the rates of nucleation of all phase transformations as well as of fracture cracks, slip bands and magnetic transformations in solids. A.

548.53 : 532.782

768. Inclusions in aluminium crystals. May, W., Tiedema, T. J. and Burgers, W. G. Letter in *Nature, Lond.*, **162**, 740–1 (*Nov.* 6, 1948).—When worked aluminium recrystallizes, grains forming approximate (within $\sim 5°$) spinel twins with the recrystallized matrix are not absorbed. Grains that are exact spinel twins are stimulated to form recrystallization nuclei [compare Abstr. 3722 (1947)]. A. J. C. W.

MOLECULAR AND X-RAY CRYSTALLOGRAPHY 548.7

548.7

769. The long range of the regular atom-ordering in solid solutions. van der Waerden, B. L. *Z. Phys.*, **118** (*Nos* 7–8) 473–88 (1941) *In German.*—It is argued that the scheme of long-range order extends throughout crystals of composition *AB*, the cases considered being simple cubic, body-centred cubic and a square plane net. The reasoning in this last case proceeds as follows. The portions of the plane ordered according to the "wrong" scheme can be divided from the rest by means of closed right-angled polygons, and the number of such polygons with edge-length equal to y interatomic distances is at the most $N.3^y$ where N i the number of atoms. The boundary energy i proportional to the length of the polygon, and fo temperatures appreciably below the critical tem perature T_c the Boltzmann factor $\exp(-v/kT$ restricts polygons with edge-length $< \sim 40$ to fraction less than 10^{-8} of the total number. A approximate reckoning of the number of atom enclosed by polygons of length less than about 4 shows that the fraction of atoms in the "wrong places is $\sim 2^{-4T_c/T}$, and this is small for $T < \sim \frac{3}{4}T_c$ (The approximations made do not hold for large values of T.) Similar considerations apply to th cubic cases. In the final section the calculated relativ numbers of polygons of different sizes are used t develop series for the energy and long-range-orde parameters in powers of the Boltzmann factor. A. J. C. W

548.7 : 539.132 : 535.343.

Theory of the absorption spectra of molecula crystals. *See Abstr.* 534

548.73 : 537.531 : 535.31

770. Measurement, by means of a Geiger counte with single-impulse counting, of the intensity of th X-rays diffusely scattered by crystals. Wagner, G and Kochendörfer, A. *Z. Naturforsch.*, **3a**, 364–5 (*June*, 1948) *In German.*—Geiger-counter measurements at room temperature showed no change in the diffuse scattering by Zn and Al on working. A theoretical estimate shows that the effect to be expected is of the same order as the accuracy of measurement (8%). Measurements at lower temperatures, where the effect should be larger, and on "active" materials, are planned. A. J. C. W

548.73 : 545.824

Basic aspects of X-ray absorption. *See Abstr.* 760

548.73/.74 : 537.533.74 + 537.53

771. The effect of incoherent scattering on the diffraction of electrons and X-rays by crystals. Boersch, H. *Optik*, **3** (*Nos* 1–2) 24–7 (1948) *In German.*—A discussion of the inelastic scattering of X-rays and electrons by a crystal lattice and its influence on the diffraction pattern obtained by transmission through thin crystals. Whereas diffraction is normally regarded as a phase effect, inelastic scattering superimposes an amplitude effect due to the periodic change in amplitude of the transmitted beam. An estimate is made of the magnitude of the latter effect, which is $\ll$ the former, under the conditions considered. M. R. H

548.732

772. Correction factors in the measurement of the small angle scattering of X-rays. Guinier, A. and Fournet, G. *J. Phys. Radium* (*Sér.* 8) **8**, 345–51 (*Dec.*, 1947) *In French.*—Surveys briefly previous work on the corrections to be applied to X-ray intensity curves obtained by small angle scattering, with slits as opposed to pinholes. General correction formulae are developed for slits of finite and infinite height, and it is pointed out that such formulae are indispensable in the experimental work which is still necessary to establish a satisfactory theory of small angle scattering J. T

548.732.2 : 537.531 : 535.4

773. On the derivation of Bragg's law. MENZER, G. *Z. Naturforsch.*, **2a**, 683–4 (*Nov.–Dec.*, 1947) *In German.*—The assumption of specular reflection from a net plane is avoided. A. J. C. W.

548.733

774. High-temperature X-ray diffraction apparatus. VAN VALKENBURG, A. AND MCMURDIE, H. F. *Bull. Amer. Ceram. Soc.*, **26**, 139–42 (1947).—Details are given of a Norelco X-ray spectrometer with Geiger counter and equipped with a furnace enabling powder-diffraction patterns to be obtained at temp. up to 1 500°. Patterns can be obtained in 40 min and without the intermediate cooling of the sample between each test. Complete details are given of the sample holder and furnace, the windows of which are thin sheets of Be. $2CaO,SiO_2$ at 1 500° was shown to be hexagonal with $a = 5{\cdot}08$ kX and $c = 7{\cdot}05$ kX. B. A.

548.734

775. X-ray diffraction maxima at very large angles. HENDUS, H. AND NOWOTNY, H. *Naturwiss.*, **35** (*No.* 2) 61–2 (1948) *In German.*—For $\theta > 85°$ the Debye–Scherrer lines from a rotated metal specimen are made up of sickle-shaped streaks, the loci of reflection from individual crystals. When the axis of rotation is accurately parallel to the incident beam the streaks become circles concentric with the beam. A. J. C. W.

548.734.8

776. Statistical factors affecting the intensity of X-rays diffracted by crystalline powders. ALEXANDER, L., KLUG, H. P. AND KUMMER, E. *J. Appl. Phys.*, **19**, 742–53 (*Aug.*, 1948).—The Laplacian probability equation can be used to predict the reproducibility of the intensities of X-rays diffracted by crystalline powders. If absorption is neglected, and N is the number of particles irradiated, p the proportion of particles which are oriented so as to diffract, and $q = 1 - p$, the relative mean deviation to be expected in repeated intensity measurements is given by $U_m = 0{\cdot}798(q/Np)^{\frac{1}{2}}$. When absorption and the actual distribution of particle sizes are taken into account, the expression becomes $U_m = 0{\cdot}798(q\mu v_e/pA)^{\frac{1}{2}}$, where μ is the linear absorption coefficient of the material, v_e the effective volume per particle, and A the cross-sectional area of the incident beam. The theory is confirmed by measurements on 4 size fractions of quartz powder. For typical experimental conditions and powders of medium absorbing power for X-rays, it is demonstrated that good reproducibility can be expected only if the effective particle dimension $< \sim 5\ \mu$. A.

548.734.8

777. A note on the use of X-ray counter-spectrometers for single-crystal measurements. WOOSTER, W. A., RAMACHANDRAN, G. N. AND LANG, A. *J. Sci. Instrum. Phys. Ind.*, **25**, 405–7 (*Dec.*, 1948).—Some experiments are described in which a counter-spectrometer method is compared with an X-ray photographic method as a means of determining the integrated reflection of a number of reflections. The advantages and limitations of the photographic, ionization and counter-spectrometers are discussed, and it is concluded that for long exposures the photographic spectrometer is as sensitive as the counter-spectrometer used for a few minutes and more sensitive than the ionization spectrometer. For convenience and speed of measurement the counter-spectrometer is probably the best instrument. A.

548.735.4

778. Precision measurement of crystal-lattice parameters. THOMAS, D. E. *J. Sci. Instrum. Phys. Ind.*, **25**, 440–4 (*Dec.*, 1948).—A technique is described with a discussion of the effect on the ultimate result of all errors, those due to inaccurate measurement, penetration of the specimen and divergence of the incident beam. It is shown that the errors of the first two types are negligible and the correction for the third can be calculated. Figures are given for the lattice parameter of iron. A.

548.74

779. Effect of crystal grid interference on image formation in the electron microscope. BOERSCH, H. *Z. Phys.*, **118** (*Nos* 11–12) 706–13 (1942) *In German.*—Definite black lines were observed in electron microscope photos of thin crystals. The lines are unrelated to the crystal mass structure, but are due to weakening of the primary electron beam caused by crystal grid interference. This interference is due to bending of the crystal, and the lines can be used to determine the amount of deformation. V. W. R.

548.74

780. The interpretation and application of electron-diffraction "Kikuchi-line" patterns. II. The methods of indexing the patterns. WILMAN, H. *Proc. Phys. Soc., Lond.*, **61**, 416–29 (*Nov.*, 1948).—[See Abstr. 1367 (1948)]. Seven methods are described of indexing electron-diffraction Kikuchi-line patterns from single crystals for the purpose of practical applications of such patterns. The crystal lattice form and orientation can be determined by method I (see Part I), which also gives the indices of the diffractions relative to the chosen unit cell. The other six methods are in general only applicable in conjunction with a knowledge of the crystal lattice form and orientation, in which case any one of them, or more conveniently several in conjunction, can be used to index the lines.

548.74 : 537.533.74

781. Electron diffraction from anthracene with special reference to the diffuse background. SKREBOWSKI, J. *Proc. Phys. Soc., Lond.*, **61**, 430–45 (*Nov.*, 1948).—The object of the research was to examine the diffuse pattern obtained when an electron beam is transmitted through a crystal of anthracene. A special camera adapted for low temperature work is described. It has been found that the diffuse pattern has a fine structure which is more apparent in the case of thick crystals. The changes in intensity of the diffuse pattern with the temperature have been established experimentally and it is shown that the phenomenon of the diffuse scattering is analogous to that found in X-rays.

548.74 : 545.8

782. Electron microscope goniometry. KIRKPATRICK, A. F. AND DAVIS, E. G. *Analyt. Chem.*, **20**, 965–8 (*Oct.*, 1948).—The frequent occurrence of unknown crystals in electron microscopical samples

presents the problem of their identification. Their relatively small size severely limits the ordinary methods of identification. The silhouette angles observed on the screen or photographic plate are practically all the data available to the electron microscopist. These angles are functions of the interfacial angles of the crystals and the orientation with respect to the screen or plate. The interfacial angles, constants of a suspected compound as obtained from the literature, can be used to calculate the angle of an orthographic projection of the crystal, which i observed with the electron microscope. A comparison of the angles measured with those calculated may establish the identity of the crystal. It may be possibl to determine directly axial elements (axial ratios an interaxial angles) and interfacial angles of unknow crystals. This represents the determination o physical constants with the electron microscope. A

GEOPHYSICS 55

551.46.018.9 : 532.593/.4

An instrument for recording ultra low frequency ocean waves. *See Abstr.* 473

ATMOSPHERE . METEOROLOGY 551.5

551.510.534

783. Effects of the ozone shadow. PENNDORF, R. *J. Met.*, **5**, 152–60 (*Aug.*, 1948).—The radius of the earth's shadow for ultraviolet sunlight is enlarged by an amount equal to the altitude of the upper boundary of the ozone layer. Among the effects of this ozone shadow are: (1) a delay in ionization at sunrise in the ionosphere, from which the uppermost height of the ozone layer may be calculated; (2) variations in the intensity of ultraviolet light reflected from the moon during a lunar eclipse, furnishing information concerning the vertical distribution of ozone; (3) a premature decay in the intensity of the sodium D-line at sunset, leading to calculation of the height of emission of the D-line. A.

551.510.535 : 523.5

784. A study of the ionospheric data obtained at Wuchang—Sept. 1946–Dec. 1947. LIANG, P. H., LUNG, H. L. AND WANG, S. *Chin. J. Phys.*, **7**, 115–31 (*June*, 1948) *In English.*—A summary is given of normal incidence hourly ionospheric data for Wuchang (long. 114° E., lat. 30° N.) for the period stated. The values of F_2 critical frequency confirm the geomagnetic control of the ionization density in this layer. The observations of sporadic E ionization support the suggestion that meteors are important agents in producing this ionization. W. J. G. B.

551.513

785. Stability of permanent horizontal and isobaric movement of the atmosphere. VAN MIEGHEM, J. *Inst. Roy. Met. Belge. Mem.*, **28**, 62 *pp.* (1948) *In French.*—A system of curvilinear co-ordinates is required, fixed by reference to the earth, of which one of the three families of lines of co-ordinates coincides with isobaric lines in the atmosphere, and relations are established for the geometry of surfaces. This dynamical method already used in the case of geostrophic winds is extended to the more general case of isobaric motion. The threshold of instability of isobaric motion is determined by the Coriolis parameter corrected by a curvature term. Finally the general theory is applied to a permanent circula vortex. R. S. R

551.521.11 : 628.92

786. Duration and intensity of sunshine. IV. Effects of atmosphere. BENFORD, F. *Illum. Engng, N.Y.*, **43** 699–710 (*July*, 1948).—See Abstr. 616 B (1949).

551.521.63 : 615.831.7 : 535.247.4

787. Measurements of biologically effective ultraviolet solar and sky radiation in Washington, D.C., 1941–1946. COBLENTZ, W. W. *Bull. Amer. Met. Soc.*, **28**, 465–71 (*Dec.*, 1947).—Improved apparatus has been used of which details are given. Mean monthly values are obtained for the biologically effective u.v. radiation (UVQ) and the total sky radiation (Q) and their ratios. These ratios have been employed to evaluate the former for other sites where Q is known. For the tropics UVQ is 15–20% greater than in mid latitudes, but it is similar at high latitudes to that at Washington, D.C. Values of UVQ obtained in months with exceptional weather features are discussed. [See Abstr. 2415 (1946)]. R. S. R.

551.575

788. Producing fog artificially. BRINKMAN, H. AND VERMEER, J. *Electro-techniek*, **26**, 240–2 (*July* 15, 1948); **26**, 254–7 (*July* 29, 1948) *In Dutch.*—Earlier methods had the disadvantage of the fog not being lasting or being electrically charged. A continuous generating process is described which closely resembles natural conditions. The bottom of an experimental fog chamber 60 cm square and 135 cm high is covered by a cooling element in water. The source of vapour is placed in the top and consists of a brass tray with bottom of asbestos, through which diffusion of vapour takes place. A heating element keeps the water in the tray at a temperature of 100°C. To simulate the linear vertical temperature gradient such as occurs in natural foggy air the brass walls of the tray are extended down to the bottom. The air necessary to supply fresh condensation nuclei, the amount of which can be controlled, passes slowly upwards through the chamber and escapes at the top along the sides of the hot-water tray. The degree of supersaturation required to produce fog and the vertical vapour pressure and temperature gradient are calculated. In a large region between the cold and hot surface the vapour pressure is shown to be higher than the saturation pressure corresponding to the local temperature, causing a condensation on nuclei. The size of the droplets is the same as in natural fog

The density of fog can be controlled by varying the temperature at the hot surface. J. VAN W.

551.578.11 : 621.396.91

789. Drop size intensity, and radar echo of rain. SPILHAUS, A. F. *J. Met.*, **5**, 161–4 (*Aug.*, 1948).—Abstr. 252 B (1949).

551.593.5 : 523.755 : 525.73

Researches on atmospheric diffusion and on solar radiation. *See Abstr.* 434

551.593.9 : 535.338.4

790. The spectrum of the night sky. I. Measures of wavelengths, and identifications. BARBIER, D. *Ann. Astrophys.*, **10** (*No.* 1) 47–66 (1947) *In French.*—A definitive list is given of band wavelengths, and identifications, within the spectral range, 3 084 Å–4 662 Å. The majority belong to Vegard–Kaplan (N_2), or Herzberg (O_2) systems, but 38 remain unidentified and are ascribed tentatively to a new system of CO. D. R. B.

551.593.9 : 535.338.4

791. The spectrum of the night sky. II. Spectrophotometry. BARBIER, D. *Ann. Astrophys.*, **10** (*No.* 2) 141–57 (1947) *In French.*—[See Abstr. 790 (1949)]. From a spectrophotometric study of the profiles of the Herzberg (O_2) bands in spectra of the horizon and zenith night sky, a temperature $-50°$C to $-100°$C is assigned to the emitting layer at an estimated height of 350 km. A height of 900 km is found for the Vegard–Kaplan (N_2) layer. From a further study of the night-sky continuum in the photographic region it is concluded that only 27% of the intensity is attributable to the continuous spectrum proper, 53% being contributed by emission band wings. This conclusion is at variance with the classical explanation of the night-sky continuum. D. R. B.

551.593.9 : 535.338.4 : 551.510.41

792. Spectroscopic evidence of methane in the earth's atmosphere. MIGEOTTE, M. V. *Phys. Rev.*, **73**, 519–20 (*March* 1, 1948).—Fourteen lines of the $3{\cdot}3\ \mu$ fundamental band of CH_4 have been detected in recent solar spectrograms obtained with a Pfund-type recording spectrometer. Measured wave-numbers agree well with laboratory values [Abstr. 2571 (1935)]. Water vapour absorption veils many lines in Q and R branches. Although stronger, a second band at $7{\cdot}7\ \mu$ is masked by lines of H_2O vapour, and N_2O, making confirmation of atmospheric CH_4 difficult. D. R. B.

551.594 : 537.56

793. Atmospheric electricity: Ionic equilibrium in the lower atmosphere. BRICARD, J. *C.R. Acad. Sci., Paris*, **226**, 1536–8 (*May* 10, 1948) *In French.*—By considering mathematically the densities, coefficients of diffusion and mobilities of small + and − ions in the neighbourhood of condensation centres, an expression is derived for the ratio of the total number of centres to the number of neutral centres, and thence for the ionization intensity. The latter is found $\simeq 7$, a value agreeing with that recorded by Gish. A. C. C.

551.594.22

794. A photograph of bead lightning. SCHEMINZKY, F. AND WOLF, F. *S.B. Akad. Wiss. Wien*, **156**, *Abt. IIa* (*Nos* 1–2) 1–8 (1948) *In German.*—A photographic reproduction and an enlargement are given of a case of bead lightning taken in 1933 in the Austrian Tyrol. The doubts raised by one expert to whom the original film was submitted for comment are answered and from the opinion expressed by a second expert it is concluded that a genuine photograph of bead lightning involving the Clayden effect had been secured. The size of the pearls and the distances between them are determined and are compared with an earlier example. R. H. G.

551.594.6 : 523.746 : 621.396.11

795. Sunspots and radio weather. ARZINGER, A., HALLBORG, H. E. AND NELSON, J. H. *RCA Rev.*, **9**, 229–44 (*June*, 1948).—Abstr. 215 B (1949).

551.594.6 : 621.396.91

796. The collection of radar-meteorological data. HANSFORD, R. F. *J. Inst. Navig.*, **1**, 257–62 (*July*, 1948).—Abstr. 253 B (1949).

551.594.9 : 551.510.535 : 550.385

797. The induction of electric currents in a non-uniform ionosphere. ASHOUR, A. A. AND PRICE, A. T. *Proc. Roy. Soc. A*, **195**, 198–204 (*Dec.*, 1948).—Calculations are made of the distribution and the magnetic field of the currents induced in a non-uniformly conducting ionospheric shell by an external magnetic field, which is either periodic or subject to sudden changes. Assuming that the initial phase of magnetic storms is due to field changes outside the ionosphere, it is shown that its mean integrated conductivity is probably not much greater than 10^{-7} e.m.u. It is found that electromagnetic shielding by the ionosphere has an important effect on the distribution of field changes observed on the earth, and may lead to an apparent diurnal variation of frequency of occurrence of sudden commencements at a given station. Simple explanations are suggested for some known features of micropulsations, and for some well-known phenomena of magnetic disturbance, including Sangster's rotating disturbance vector. A.

BIOLOGY 57/59

578 : 536.423.08 : 545.72

798. An apparatus and method for the continuous measurement of evaporative water loss from human subjects. PALMES, E. D. *Rev. Sci. Instrum.*, **19**, 711–17 (*Oct.*, 1948).—The rate of evaporative water loss is measured by recording the difference in water vapour concentration in a stream of air before and after it passes over a man enclosed in a sealed chamber. An infrared gas analyser is employed for measuring the difference in water vapour concentration. Construction and application of the apparatus are discussed. A.

591.18 : 518.5

799. Steady states in random nets. I. RAPOPORT, A. AND SHIMBEL, A. *Bull. Math. Biophys.*, **10,** 211–20 (*Dec.*, 1948).—A neural net is taken to consist of a semi-infinite chain of neurons with connections distributed according to a certain probability frequency of the lengths of the axones. If an input of excitation is "fed" into the net from an outside source, the statistical properties of the net determine a certain steady state output. The general functional relation between the input and the output is derived as an integral equation. For a certain type of probability distribution of connections, this equation is reducible to a differential equation. The latter can be solved by elementary methods for the output in terms of the input in general and for the input in terms of the output in special cases. A.

591.18 : 518.5

800. Steady states in random nets. II. RAPOPORT, A. *Bull. Math. Biophys.*, **10,** 221–6 (*Dec.*, 1948).—Two semi-infinite chains are considered interacting as random nets. Conditions for steady state are derived for the cases of cross-excitatory and cross-inhibitory association connections. In the cross-inhibitory case a unique non-trivial self-reproducing steady state is shown to exist. A.

591.181

801. The nervous system as an electrical instrument. MATTHEWS, B. H. C. *J. Instn Elect. Engrs, Pt I,* **95,** 397–401 (*Sept.*, 1948).—A general review of recent advances in electro-physiology, in particular present knowledge of the structure and transmission of nerve impulses. The relationship between experimental advances and the development of electrical recording instruments is examined. The sensitivities of sense organs whose responses are transmitted to the brain by trains of nerve impulses, and the summation of electrical activity which produces brain potentials, are also discussed. E. E. C.

MEDICAL SCIENCE . HUMAN PHYSIOLOGY 61

612.014.423 : 517.512.2

802. The wave analysis of l.f. potentials of the human body. BOYD, W. E. *J. Brit. Instn Radio Engrs,* **8,** 75–83 (*March–April*, 1948).—Fluctuations in the body potentials as recorded by electrocardiograph are due to the heart's action. Similar variations in the region of the head, discovered by Berger *et al* in 1929, resulted in the development of electro-encephalography. The author has analysed a further range of frequencies, 10 to 2 500 c/s on the general body surface by means of an amplifier of 10^6 theoretical and 6×10^4 practical distortionless amplification. After the necessary corrections for skin moisture, etc., it could be shown that these variations of potential are unrelated to the heart's action, particularly in the higher frequency range. The factors accounting for the shape of the electrocardiogram are: (*a*) rhythm, (*b*) conductivity, (*c*) irritability, (*d*) contractility, and (*e*) tonus, though the electrocardiograph fails where estimation of contractile force and tonus of the heart muscle are concerned. It is claimed that the author's analytical method closes this gap by using a theoretical curve obtained by Fourier synthesis, and comparing it with the electrocardiogram. It shows deviations apparently due to the muscle or other causes which studied by the suggested method, might supply data of practical medical value on myocardial efficiency and neuro-muscular phenomena. Details of the apparatus are given and, in an appendix, W. E. Benham discusses Fourier analysis in its application to the specific problem. B. J. L.

612.014.43.44 : 615.831 : 536.35

803. Light transmission by tissues of human body in near infra-red. ILJINA, A. A. *C.R. Acad. Sci. URSS,* **54** (*No.* 7) 591–4 (1946) *In English.*—The infrared transmission spectra of the ear and cheek in living man were measured by means of a photoelectric spectrophotometer. Two maxima occur in the range 500 mμ–1 200 mμ, and the spectrum in the near infra-red is determined almost entirely by the optical properties of blood and water. The shape of the transmission curve may serve as a basis for qualitative estimates of the degree of oxidation of the blood, a knowledge of which is important in a study of the behaviour of the body at high altitudes. L. S. G.

612.816.1/.2 : 612.822.3 : 616–073.97

804. Charting the sea of brain waves. JASPER, H. H. *Science,* **108,** 343–7 (*Oct.* 1, 1948).—Presidential address before 2nd annual meeting of the American Electro-encephalographic Society, June 1948, being a short survey of developments in electro-encephalography during the last 15 years. Bibliography of 55 items.

612.84

805. Dependence of the threshold contrast on exposure time. LUISOV, A. V. *Dokl. Akad. Nauk, SSSR,* **60** (*No.* 3) 379–83 (1948) *In Russian.*—[Cf. Luisov, A. V. *Dokl. Akad. Nauk. SSSR,* **57** (*No.* 8) (1947)]. In continuation of earlier work the author proceeds to integrate the function given by him on the assumption of an experimental curve of either 3rd order or exponential character. The experimental evidence favours the exponential law. B. F. K.

612.84

806. The measurement of the eye movements of a prone observer during monocular fixation. LORD, M. P. *Proc. Phys. Soc. Lond.*, **61,** 489–93 (*Dec.*, 1948).—A critical survey of previous work on the measurement of fixation eye movements shows that none of it has satisfied all the conditions: (i) possibility of detection of movements of magnitude one minute of arc; (ii) little interference with the natural state of the eye; (iii) satisfactory treatment of the head movement problem. A technique which more nearly meets these requirements is described. Photoelectric recording of the movements of an ultraviolet beam reflected from the surface of the cornea enables the first and second conditions to be satisfied. The reflected beam is divided into 2 parts, one of which falls on a horizontal straight edge, the other on a vertical straight edge. In each case more or less of the radiation

passes the straight edge as the eye moves, and is focused on an electron multiplier phototube. The output of each multiplier is amplified and fed to a cathode-ray oscillograph, the time-base of which is suppressed. The oscillograph beams are thus arranged to give vertical traces only, and these are photographed simultaneously on a continuously moving film travelling in the horizontal direction. The eye movements can be deduced from the two records on the film. In an attempt to meet the third requirement the subject is placed in the prone position, in which the movements of the ultraviolet beam due to head movements are smaller than for other positions of the subject. No attempt at analysis of the observations has yet been made. A.

612.843.321/.322

807. The fundamental response curves of normal and abnormal dichromatic and trichromatic eyes. DE VRIES, H. *Physica, 's Grav.*, **14**, 367–80 (*Aug.*, 1948) *In English.*

615.84 : 621.396.615.17

808. Medical stimulus circuits. GILSON, W. E. *Electronics*, **21**, 99–101 (*July*, 1948).—Abstr. 557 B (1949).

615.849 : 537.531

809. Some observations on the nature of the radiations emitted by X-ray tubes. MANOUKHINE, J. *C.R. Acad. Sci., Paris*, **227**, 56–8 (*July 5*, 1948) *In French.*—Early work by the author demonstrated that doses of 26–30 r emitted by a gas X-ray tube, filtered by 1 mm Al, produced an enzyme leucocytolysine in the blood of patients, resulting in a reduction in liver size. Recent attempts using hot cathode X-ray tubes and self-protected units did not produce the same therapeutic result. It was shown that the effective radiation from gas X-ray tubes was stopped by 2 mm Pb and transmitted by 1 mm Al. T. A. C.

616–07 : 591.11

810. Radiocardiography: A new method for studying the blood flow through the chambers of the heart in human beings. PRINZMETAL, M., CORDAY, E., BERGMAN, H. C., SCWARTZ, L. AND SPRITZLER, R. J. *Science*, **108**, 340–1 (*Sept.* 24, 1948).—A recording G.M. counter is used over the precordium to trace the passage of radiosodium through the heart. The characteristic biphasic curve for normal patients is replaced by curves of modified shape in patients with heart disease. H. MI.

PHOTOGRAPHY 77

771.36 : 621.38

811. Testing photographic shutters. DUFFIELD, J. H. AND LANKES, L. R. *Electronics*, **21**, 82–7 (*Aug.*, 1948).—Abstr. 495 B (1949).

771.5 : 539.172

812. Photographic plates for use in nuclear physics. WEBB, J. H. *Phys. Rev.*, **74**, 511–32 (*Sept.* 1, 1948).—The registration of charged particles by the photographic emulsion is considered from the standpoint of their space rate of energy loss on passage through matter. On the basis of the highest-energy particles that can be recorded as recognizable tracks, an energy-loss value of 0·013 MeV per centimetre of air path is taken as an approximate threshold sensitivity value of the best present-day nuclear-particle emulsions. This energy-loss value corresponds to α-particles of energy > 400 MeV, deuterons of 200 MeV, protons of 50 MeV, and electrons of 10 keV. Some evidence is cited to show that these limiting energy values are in accord with experience. Range-energy curves for α-particles, protons, deuterons, and mesons in high silver halide concentration emulsions are given, based on constant stopping-power values of the emulsion. A relative stopping power value of 1 800 is used for α-particles, and a value of 2 000 is used for protons, deuterons and mesons. Data on the composition, physical characteristics, and sensitivity, and also recommended uses of some of the commercially available nuclear-particle emulsions are presented. A theoretical calculation of the stopping power of the photographic emulsion relative to that of air is given. Curves of stopping power vs. energy for α-particles and protons in a high silver halide content emulsion are calculated and compared with published experimental values. Grain density and its variation in the recorded tracks of nuclear particles in the photographic emulsion are discussed. It is pointed out that the grain density for low-energy particles approaches a maximum value determined by the grain population of the unexposed emulsion. A qualitative discussion is given to show why grain spacing varies with particles of differing ionizing power. Finally, the mechanism of latent-image formation is considered from the standpoint of ion-pair production in the grain. Using the energy-loss value of 0·013 MeV per centimetre as a threshold limit and a value of 7·6 eV for the energy required to produce an ion pair in silver bromide, it is shown that about 150 ion pairs must be produced in a single grain to form the latent image. A.

771.534 : 541.147

813. The blackening law of photographic films under intermittent exposure. SHTAUDEL, A. E. *J. Tech. Phys.*, **18**, 1069–72 (*Aug.*, 1948) *In Russian.*

771.535

814. Notes on latent image theory. MOTT, N. F. *Photogr. J.*, **88 B**, 119–22 (*Nov.–Dec.*, 1948).—Deals with three aspects of latent image theory which have been criticized since the orginal Gurney–Mott paper was published. The first note shows that there is no difficulty in understanding how, in photographic development, ionic movement is maintained to keep pace with measured rates of production. In this respect, development is no different from electrolytic reduction, which is known to occur readily in Ag halides. The second note deals with the fate of the Br atoms formed during exposure and describes the properties of suitable halogen acceptors in terms of electron levels. The third note describes the new mechanism of sensitization. The known positions of the electron levels in the dye and Ag halide require a

mechanism in which the energy of the excited dye molecule and not an actual electron is transferred to the crystal. It is possible that the weak adsorption at long wavelength of the photographic emulsion grains is sufficient to make this mechanism plausible. A.

778.33 : 537.531.8

815. Electronic radiography and microradiography. TRILLAT, J.-J. *J. Appl. Phys.*, **19**, 844–52 (*Sept.*, 1948).—Two techniques of radiography by means of secondary photoelectrons liberated by hard X-rays (180 kV), one by reflection and one by transmission, are described. Special fine-grained photographic emulsions of the Lippmann type are required which will not be affected by X-rays traversing the film, but are sensitive to photoelectrons liberated from the surface of a specimen in intimate contact with the photographic film or paper. In this way photographic negatives may be reproduced (from the silver of the image), microradiographs prepared by enlargement of any area of the radiograph, surface topography studied, ores analysed, etc. For electronic radiography by transmission, instead of the specimen being its own electron generator, a thin metal foil (usually lead) pressed against the specimen generates the electrons which then traverse the thin specimens, and register on the photographic film or paper. Applications are papers, insect wings, varnish or rubber films, plant leaves, tissue sections, plastics and alloys. A.

778.6 : 535.623.5

816. Numerical determination of colour reproduction in additive colour photography under various conditions. SCHULTZE, W. AND HÖRMANN, H. *Z. wiss. Photogr.*, **43** (*Nos* 1–8) 13–44 (1948) *In German.*—Colour reproduction has been worked out in detail for the following groups of additive methods of colour reproduction: (1) Use of three "ideal" filters (square-topped transmission curves) for taking and reproduction; (2) taking filters with overlapping transmission regions; (3) taking filters with transmissions corresponding to the normal C.I.E. sensation curves; (4) taking filters to correspond to the reproduction filters according to Hardy and Wurzburg [Abstr. 4014 (1937)]; (5) use of spectral colours for reproduction. It is concluded that taking filters with large overlaps cause poor colour reproduction, in particular if filters corresponding to the normal C.I.E. sensation curves are used. The taking filters according to Hardy (ref. above) give good results, if the negative portions and the regions of overlap are neglected. Colour reproduction is almost as good for ideal filters which do not include the ends of the visible spectrum and which may have gaps left between their transmissions. If the colours to be reproduced are spectral colours, a reasonable degree of overlap of the taking filters is favourable. No significant difference was found between the colour reproduction of ideal dyes a saturated pigments, whereas spectral colours w found unsuitable for testing purposes. W. F.

778.6 : 535.6

817. Application of objective testing methods to subtractive colour film with special consideration of Agfacolor system. HÖRMANN, H. AND SCHULTZE, *Z. wiss. Photogr.*, **43** (*Nos* 1–8) 44–52 (1948) *German.*—The colour reproduction of the varic methods comprising the Agfacolor system has be tested, using 8 pigment colours chosen from t Baumann (system Prase) set of test colours. Measu ments on a number of flowers have shown that t Baumann colours are as saturated as any that a likely to occur in nature. Colour reproduction judged using the Rucs colour triangle [Breckenrid F. C. and Schaub, W. R., Abstr. 4291 (1939)] for t assessment of colour differences, and the Webe Fechner law as corrected by Klughardt, A. [*Z. Sinn physiol.*, **67**, 69 (1936)] for the deviations in brightne In general it is found that colours tend to becor desaturated by the photographic process unc discussion. W. F.

778.6 : 535.6

818. Representation of the colours which can obtained by the Agfacolor-positive dyes. SCHULTZ W. AND HÖRMANN, H. *Z. wiss. Photogr.*, **43** (*Nos* 1- 53–9 (1948) *In German.*—A solid body comprising colours obtainable by subtractive mixture of t Agfacolor positive dyes has been determined, using t C.I.E. values x and y and the brightness $\bar{y}$ as c ordinates. Most natural colours lie well within t body found. It is pointed out, however, that this do not mean that the natural colours will be reproduc faithfully, but merely that the system is in princi capable of reproducing them. A large number pigments, paints and natural colours have be photographed and shown to lie within the calculat colour solid. W. F.

778.6 : 535.6

819. Contribution to the mathematical treatment the subtractive method of colour reproduction. Fundamentals of the metrics of colour sensations a the (bases for) concentration and colour series. HEI MIG, E. *Z. wiss. Photogr.*, **43** (*Nos* 1–8) 68–85 (194 *In German.*—The problem of subtractive colo reproduction is treated using "ideal" (square-toppe transmission functions for the three dyes. A co centration series of such dyes yields a fixed point the C.I.E. colour triangle. Concentration series any other types of dyes, such as the natural dyes a pigments, produce traces in the triangle, which a always curved, unless the dyes are mixed with whi In exceptional cases the colour traces can form loo These results are illustrated on the set of dyes us for the Agfacolor film. W. F.